APPENDICES

APPENDIX I

Findings and

Recommendations

Summary Chart

INSPECTION FINDINGS AND RECOMMENDATIONS SUMMARY

Main House, William Floyd Estate

Inspection Findings	Recommended Actions	
Outside, East Side		
Signs of wood rot by window frame	Remove damaged wood; replace with BoraCare or TimBor Pro-treated wood; paint to match with quality oil-based paint	
Water diversion flashing holding leaves & dirt; wood has 30 – 40% moisture	Clean to allow water flow. Extend flashing 2.54 cm (1 in) over the edge. Install rain gutters & downspouts	
Leaf litter under structures holds moisture & provides harborage for insects & rodents	Remove leaf litter & other debris from under structures	
Gaps under coal shed allow pest harborage	Repair gaps under coal shed to prevent pest access	
Multaflora rose (<i>Rosa multiflora</i> Thunb.), an exotic invasive plant	Remove all multiflora rose; cut stems at ground level; paint remaining stems with Glyphosate or Triclopyr	
Many plants (vegetation) close to building; hold moisture & provide harborage for pests	Move or prune all vegetation to .91 m (3 ft) from the structure. Create a .91 m (3 ft) vegetation-free zone next to the structure	
Outside, I	North Side	
Screen removed from north screened porch – allows flying insects to enter	Replace screen on porch	
Outside,	West Side	
Hole under house near Bilco door provides entry or	Monitor for vertebrate or arthropod presence under	
harborage for pests	structure. Remove pests; seal hole with ¼ in. hardware cloth extended below soil surface	
Boxwood too close to structure	Install trellis to hold boxwood at least .91 m (3 ft) from structure	
Raccoons or squirrels enter ductwork	Remove vertebrate pests. Trace entry into ductwork by pests. Seal ductwork with ¼ in. hardware cloth to exclude vertebrate pests	
Animal access under porch	Close access under porch with ¼ in. hardware cloth & historic fabric	
Inside, A	attic A3-1	
Dust, dirt, debris. Open gaps under eaves. Mud dauber nests & spider webs present	Thorough cleaning. Perform exclusion to fill all gaps. Remove all mud dauber nests. Remove spider webs. Treat all wood beams & other wood material twice with BoraCare or TimBor Pro to protect from WDOs	
Hole chewed in wall at end of crawlspace provides access for squirrels or mice	Repair hole with ¼ in. hardware cloth; cover with historic fabric (wood & mortar)	
1740-60 portion by the bulkhead; there is a hole with grease mark (rodent access); holes in floor with hair caught; a cache of nuts behind the window box shelf; squirrel droppings & nesting material; substantial detritus in corners	Thoroughly clean attic to remove all evidence of pest activity. Close all holes with ¼ in. hardware cloth to exclude vertebrate pests. Inspect weekly for pest activity. If vertebrate activity resumes, set fine-tuned Victor rat traps baited with chunky-style peanut butter. Check rodent traps daily. Treat all wood material with BoraCare or TimBor Pro.	

Main House, William Floyd Estate (cont'd)		
Inspection Findings	Recommended Actions	
Inside, A	ttic A3-2	
Dust, dirt, debris present	Thoroughly clean this area	
Beams recorded 13% moisture; susceptible to WDOs	Treat all wood beams & other wood material twice	
	with BoraCare or TimBor Pro	
Broken wood pieces, rodent droppings, nest under the	Thoroughly clean area & remove nest material. Fill	
roof; clean fresh hole chewed through the floor (.91 m	hole with Stuf-Fit & seal with ¼ in. hardware cloth.	
[3 ft.] from nest) to subfloor below	Inspect to find all entry points for arthropods or	
	vertebrates, then securely seal them	
Inside, A	attic A3-3	
Dust, dirt, debris present	Thoroughly clean this area, especially the closet	
Wood beams & other wood material susceptible to	Treat all wood beams & wood material with BoraCare	
WDOs	or TimBor Pro	
Spiders captured in sticky trap	Continue to monitor with sticky traps & check	
	periodically (monthly) for pest activity	
, , , , , , , , , , , , , , , , , , , ,	Bedroom, Rose Room M2-1	
Dust, dirt present	Thoroughly clean this room periodically	
Moisture damage on ceiling above window & drapes	Determine source of moisture & repair	
Damaged paint on window sills from moisture	Determine source of moisture & repair	
Hole present in the corner of the fireplace	Fill hole with Stuf-Fit; seal with ¼ in. hardware cloth	
	& cover with historic mortar	
Leaves present in the bottom of the fireplace	Remove the leaves. Install a chimney cap to prevent	
	entry of leaves & arthropod or vertebrate pests	
Spiders captured in sticky traps	Continue monitoring with Lo-Line sticky traps. Check traps at least monthly	
Inside Second Flo	or, Bedroom M2-2	
Old water damage to the wall	Determine moisture source & provide repairs	
Carpenter ants, adult varied carpet beetle, adult	Carpenter ants & anobiid beetle need wood moisture	
anobiid beetle in sticky trap	13% & over to develop. Determine moisture source &	
r	provide repairs. Treat all wood twice with BoraCare or	
	TimBor Pro. Check and clean (HEPA vacuum) all	
	fabrics in the bedroom, pillows, covers, drapes, rugs,	
	clothing, etc. Inspect for larvae, cast skins, adult	
	beetles & frass	
Inside, Second Floor, Bedroom M2-3		
Dust, dirt present	Thoroughly clean this room. No pest evidence;	
_	continue monitoring with Lo-Line sticky traps	
Inside, Second Floor, Bedroom M2-4		
Dust, dirt present	Thoroughly clean this room. Continue Lo-Line sticky	
	trap monitoring. No pest evidence	
Inside, Upstairs Hall, M2-6		
Dust, dirt present; dermestid larvae cast skins & larvae	Thoroughly clean (HEPA vacuum) all fabrics	
feeding damage on blanket	(couches, pillows, blankets, drapes, rugs, etc.). Check	
	for dermestid beetle larvae & adults, cast skins &	
	feeding damage. Continue monitoring with Lo-Line	
	sticky traps	

Main House, William Floyd Estate (cont d)	.
Inspection Findings	Recommended Actions
	Bedroom M2-8
Dust, dirt present; dermestid larvae feeding damage on	Inspect & thoroughly clean (HEPA vacuum) all fabric,
hat	pillows, linens, blankets, rugs, clothing, drapes, etc.
	Continue monitoring with Lo-Line sticky traps
Inside, Bed	room M2-9
Dust, dirt present; dermestid larvae, carpenter ants,	Thoroughly clean (HEPA vacuum) all fabrics
spiders observed in sticky traps	(mattresses, pillows, covers, linens, blankets, rugs,
	clothing, drapes), cracks & crevices to remove larvae,
	beetles & any organic material beetle larvae & ants
	can feed on. Treat cracks & crevices with DE or
	Disodium Octaborate Tetrahydrate (DOT) dust.
	Continue monitoring with Lo-Line sticky traps
Inside, The Gard	len Room M2-10
Dust, dirt present. No evidence of pests	Thoroughly clean this area. Continue to monitor with
	Lo-Line sticky traps
Inside, Sleeping Porch NW2-1	
Dust, dirt present; substantial wood damage from	Thoroughly clean this area. Determine the moisture
moisture in the roof and wall. Moisture reading 17%.	source and perform repairs. Replace badly damaged
Floor wood moisture reading 40%. Wood-boring	wood. Treat all wood twice with BoraCare or TimBor
beetle damage. Wasps present	Pro. Remove wasps with vacuum. Remove nest if
	present
Inside, Bedr	oom NW2-2
Dust, dirt present; spiders in sticky trap by dresser	Thoroughly clean this area. Install a pest-proof
	chimney cap to exclude squirrels, birds, etc. eal
	fireplace flue with ¼ in. hardware cloth
Inside, Ba	th NW2-3
Dust, dirt present; water damage; spiders in a sticky	Thoroughly clean this area. Determine moisture source
trap	and perform repairs. Continue monitoring with Lo-
	Line sticky traps
	th NW2-5
Dust present; no evidence of pest presence	Thoroughly clean this area. Continue monitoring with
	sticky traps
Inside, Mizzen	Bedroom E2-1
Dust, dirt present; floor spongy from squirrel nest	Thoroughly clean this area. Remove floor boards &
between floors. Moisture damage. Pest access under	replace if necessary. Remove all nest material &
window. Spiders & dermestid larvae in sticky trap	droppings. Treat all wood material, beams, flooring,
	etc. twice with BoraCare or TimBor Pro. Determine
	moisture source & perform repairs. Reinforce weak
	beams or flooring, if necessary. Clean (HEPA
	vacuum) all fabric (bedding, mattresses, pillows,
	linens, blankets, rugs, clothing, drapes, etc.). Continue
	monitoring for pests with Lo-Line sticky traps

Main House, William Floyd Estate (cont'd)		
Inspection Findings	Recommended Actions	
Inside, Fo'c'sle	Bedroom E2-2	
Dust, dirt present; moisture damage. Anobiid beetle,	Thoroughly clean (HEPA vacuum) all fabrics, linens,	
spider beetle, spiders captured in a sticky trap	blankets, clothing, rugs, drapes, etc. Determine	
	moisture source & make repairs. Search for dead	
	animals, insects, furs, etc. Treat cracks & crevices with	
	DE or DOT dust. Continue monitoring with Lo-Line	
	sticky traps	
Inside, Store	room NE2-1	
Dust, dirt present; moisture damage; hole in the	Thoroughly clean this area & remove spider webs with	
ceiling; rodent droppings & food on air duct; spider	a Webster or HEPA vacuum. Repair the hole in the	
webs & eggs; adult & larvae dermestid beetles &	ceiling. Determine rodent access routes & set snap	
crickets in sticky traps	traps (monitor snap traps daily). Exclude rodents with	
	¹ / ₄ in. hardware cloth. Determine moisture source &	
	provide repairs	
Inside, Storeroom NE2-2		
Dust, dirt present; hole in the bathroom ceiling into the	Thoroughly clean this area. Overlay ½ in. wire with ¼	
attic; window sill has chewing damage; stuffed birds	in. hardware cloth to prevent rodent access. Repair	
in poor condition	hole in ceiling. Repair window sill. Taxidermist to	
	clean & check for dermestid evidence or damage on	
	stuffed birds	
Inside, B	eath E2-5	
Dust, dirt present; moisture damage around window;	Thoroughly clean this area. Determine moisture source	
hole around pipe race; dermestid larvae & adult beetle	& provide repair. Fill hole around pipes with Stuf-Fit	
in sticky trap	& plaster over. Continue to monitor for arthropod	
	pests with Lo-Line sticky traps	
Inside, First Floor,	Dining Room M1-1	
Dust, dirt present; ceiling beam holes; mold in	Thoroughly clean this room. Reduce humidity. Treat	
medicine case; spider webs; old powderpost beetle	ceiling beams twice with BoraCare or TimBor Pro (by	
damage; books with old silverfish damage	injection). Remove spider webs with a Webster or	
	vacuum. Monitor horn & birds for dermestid beetle	
	larvae. Reduce humidity near artifacts & bookcases.	
	Place Dekko Silverfish Paks behind books to manage	
	(kill) silverfish or psocids. Continue monitoring for	
	crawling arthropods with Lo-Line sticky traps	
Inside, Pantry M1-2		
Dust, dirt present; wood borer damage in tea cart;	Thoroughly clean this area. Inspect tea cart	
sawbug, spider, predaceous ground beetle & insect	periodically for active wood borer damage. Continue	
frass in sticky traps	monitoring for crawling arthropods with Lo-Line	
	sticky traps	

Main House, William Floyd Estate (cont'd)		
Inspection Findings	Recommended Actions	
Inside, Gun	Room M1-3	
Dust, dirt present; wood borer damage; chimney	Thoroughly clean this room. Treat all exposed wood	
closet, ceiling & door frame are collapsing; rodent	with BoraCare or TimBor Pro to prevent further WDO	
hole in closet beside fireplace; wooden toys have	damage. Repair wood beams & door frame, & treat	
powderpost beetle damage	with BoraCare or TimBor Pro. Fill the rodent hole in	
	the closet with Stuf-Fit & seal with ¼ in. hardware	
	cloth. Monitor for squirrel or other rodent activity (set	
	Victor snap traps with chunky peanut butter bait) &	
	check traps for captures daily. Place wood toys on	
	white paper to monitor for fresh frass; then treat with	
	heat at 60 - 71°C (140 - 160°F) for at least one hour to	
	kill larvae	
,	n Hall M1-4	
Dust, dirt present; clothes moth evidence	Thoroughly clean this area. Check the master chimney	
	for rodent activity. Install chimney cap to prevent bird	
	& rodent entry. Install ¼ in. hardware cloth in the	
	chimney flue to prevent vertebrate entry. Vacuum	
	(HEPA) all fabrics (rugs, drapes, linens, etc.) for	
	clothes moth or dermestid larvae. Continue to monitor	
T '1 D	for pests with Lo-Line sticky traps	
·	arlor M1-5	
Dust, dirt present; no evidence of arthropod or	Thoroughly clean this room. Install ¹ / ₄ in. hardware	
vertebrate pests present	cloth in the fireplace flue. Install a chimney cap to	
	prevent vertebrate entry. Continue to monitor for crawling insects with Lo-Line sticky traps	
Incida Ot	Fice M1-6	
Dust, dirt present; insect damage on books;	Thoroughly clean this area. Reduce humidity. Place	
reproductive carpenter ant found on sticky trap;	Dekko Silverfish Paks behind books to attract & kill	
weather-stripping installed on outside doors of	silverfish or psocids. Continue to monitor for crawling	
emergency exits	insects with Lo-Line sticky traps	
	Litchen NW1-1	
Dust, dirt present; evidence of moisture leaks in the	Thoroughly clean this area. Determine the source of	
roof & siding; a clerid beetle & a predacious ground	moisture & make necessary repairs. Treat all	
beetle were captured in a sticky trap; hole in wall	accessible wood with BoraCare or TimBor Pro to	
under the sink; eastern subterranean termites were	manage WDOs. The hole under the sink needs to be	
captured on a sticky trap beside the stove; termites	repaired with Stuf-Fit and ¼ in. hardware cloth to	
known to swarm here & carpenter ants also have been	prevent pest entry. Enter the crawl space under the	
seen in the past	kitchen & inspect for mud tubes; break mud tubes &	
T	reinspect the next day for repaired mud tubes which	
	equals an active termite colony. Also inspect for	
	wood/soil contact which allows termite access to the	
	structure. Dry out the soil beneath the building. Treat	
	all exposed wood under the building twice with	
	BoraCare or TimBor Pro. "Termi-mesh," a fine woven	
	stainless steel mesh can be installed between wood &	

Main House, William Floyd Estate (cont'd)	
Inspection Findings	Recommended Actions
Inside, New Kitch	en NW1-1 (cont'd)
	foundation to block termite access. The continued presence of an active eastern subterranean termite colony may require a commercial pest control
	company. Continue to monitor for crawling insects
	with Lo-Line sticky traps
	ng Room NW1-3
Dust, dirt present; no evidence of pest activity here	Thoroughly clean this area. Continue to monitor for
T '1 D	crawling insects with Lo-Line sticky traps
	ath NW1-5
Dust, dirt present; no evidence of pest activity here	Thoroughly clean this area. Continue to inspect & monitor for pest presence
	Entry E1-1
Mold present on photos & the wall which is a sign of moisture intrusion	Determine source of moisture & make appropriate repairs. Reduce humidity. Occupy site during rain event to determine moisture source.
Inside, Recept	ion Room E1-2
Dust, dirt present; a gap is under the outside door; spider web behind "Declaration of Independence" painting; floor/wall junction sticky trap by the entrance door captured gnats, spiders, ants, a mite, pill bugs & several small parasitic wasps; a live dermestid larva was captured in a sticky trap by the fireplace	Thoroughly clean this area. Install a door sweep or build up the threshold to the door to exclude rodents, insects or other pests. Seal windows to exclude insects. Remove the spider web behind the "Declaration of Independence" painting. Check the fireplace & chimney for dead birds or animals. Install a chimney cap to prevent entry of vertebrates. The fireplace flue can have ¼ in. hardware cloth installed to prevent rodent entry Room E1-6 Remove nest material. Thoroughly clean this room with a HEPA vacuum. Treat the nest area with diatomaceous earth or TimBor Pro to kill mites or other parasites. Repair holes with period material backed with ¼ in. hardware cloth. Continue monitoring for crawling arthropods with Lo-Line sticky traps
dermestid pupal cases were found in sticky traps	sucky aups
	s Kitchen NE1-1
Insect frass on the flour barrel from powderpost beetle larvae infestation; a spider captured in a sticky trap at the floor/wall junction; a second inspection showed moisture damage & access by insects or rodents	Thoroughly clean area with a HEPA vacuum (cracks & crevices) to remove pest food (dust, lint, etc.). Treat barrel twice with BoraCare or TimBor Pro to protect from beetle larvae, mold or fungus. Determine moisture source & make repairs. Find & seal all pest entry points. Use ¼ in. hardware cloth for holes larger than 2.54 cm (1 in) & Stuf-Fit for smaller holes. Caulk or use period material to cover exclusion repairs. Install door sweeps on interior & exterior doors.

Inside, Storeroom NE1-2 Dust, dirt, detritus present; the slave laundry had a squirrel nest that previously collapsed the ceiling; the second inspection revealed squirrel evidence & moisture damage in the ceiling area Inside, NE1-3 Dust, dirt, debriis present; holes present in floor & behind chairs; dermestid larvae & spider beetle captured on sticky trap Inside, Slave Meal Room NE 1- Dust, dirt, detritus present; evidence of old raccoon or squirrel droppings & nesting material in damaged ceiling Inside, Slave Meal Room NE 1- Dust, dirt, detritus present; evidence of old raccoon or squirrel droppings & nesting material in damaged ceiling Inside, Slave Meal Room NE 1- Dust, dirt, detritus present; evidence of old raccoon or squirrel droppings & nesting material in damaged ceiling Inside, Back Shed NE1-4 Dust, dirt, detritus present; gap through back door; raccoon scat & carpenter ant frass present; nut shells & debris present in ceiling void; spider beetles captured in sticky trap by entrance door; hole in the wall Elevator of the remaining nest from the ceiling area. Vacuum thoroughly with a HEPA vacuum throroughly with a HEPA vacuum beroid area with DE or DOT dust to kill mites, parasites or beetles. Treat exposed wood with Bora Care or TimBor Pro. Thoroughly clean this area. Set finetuned Victor rat traps baited with shelled nuts or chunky-style peanut butter. Monitor traps daily to remove dead rodents & reset traps Thoroughly clean this area with HEPA vacuum. Determine entry points for raccoons, squirrels & other vertebrate or arthropod pests & make appropriate exclusion repairs. Apply DE or DOT dusts to kill mites, parasites or other arthropods. Continue monitoring with Lo-Line sticky traps Inside, Back Shed NE1-4 Dust, dirt, detritus present; evidence of old raccoon or squirrel droppings & nesting material in damaged ceiling exclusive presents or other arthropods. Continue monitoring with Lo-Line sticky traps Elevator of the victor rat traps baited with shelled nuts or chunky-style peanut	Main House, William Floyd Estate (cont d)		
Dust, dirt, detritus present; the slave laundry had a squirrel nest that previously collapsed the ceiling; some of the nest may remain in the ceiling; the second inspection revealed squirrel evidence & moisture damage in the ceiling area Vacuum thoroughly with a HEPA vacuum & treat the void area with DE or DOT dust to kill mites, parasites or beetles. Treat exposed wood with Bora Care or TimBor Pro. Thoroughly clean this area. Set fine-tuned Victor rat traps baited with shelled nuts or chunky-style peanut butter. Monitor traps daily to remove dead rodents & reset traps Inside, NE1-3	Inspection Findings	Recommended Actions	
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damage in the ceiling area TimBor Pro. Thoroughly clean this area. Set fine- tuned Victor rat traps baited with shelled nuts or chunky-style peanut butter. Monitor traps daily to remove dead rodents & reset traps Inside, NE1-3 Dust, dirt, debris present; holes present in floor & behind chairs; dermestid larvae & spider beetle captured on sticky trap Inside, Slave Meal Room NE 1- Dust, dirt, detritus present; evidence of old raccoon or squirrel droppings & nesting material in damaged ceiling Thoroughly clean this area with HEPA vacuum, especially all fabrics, cracks & crevices. Repair all holes with period material. Remove food sources. Continue monitoring with Lo-Line sticky traps Thoroughly clean this area with a HEPA vacuum. Determine entry points for raccoons, squirrels & other vertebrate or arthropod pests & make appropriate exclusion repairs. Apply DE or DOT dusts to kill mites, parasites or other arthropods. Continue monitoring with Lo-Line sticky traps Inside, Back Shed NE1-4 Dust, dirt, detritus present; gap through back door; raccoon scat & carpenter ant frass present; nut shells & debris present in ceiling void; spider beetles captured in sticky trap by entrance door; hole in the wall HEPA vacuum ceiling void area, then repair ceiling. Remove organic material as food source. Continue monitoring for crawling insects with Lo-	some of the nest may remain in the ceiling; the second	void area with DE or DOT dust to kill mites, parasites	
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ceiling. Remove organic material as food source. Continue monitoring for crawling insects with Lo-	captured in sticky trap by entrance door; hole in the	and inject DE or TimBor Pro dust. Repair hole in the	
Continue monitoring for crawling insects with Lo-	wall		
		ceiling. Remove organic material as food source.	
Line sticky traps		Continue monitoring for crawling insects with Lo-	
√ 1		Line sticky traps	

Inspection Findings	Recommended Actions
Ranger	Station
Dust, dirt, clutter present; ants observed in food-eating	Thoroughly clean (HEPA vacuum) this area. Eliminate
area; organic material under structure	clutter. Clean eating area after each meal. Remove
	trash at close of business daily. Treat all exposed wood
	twice with BoraCare or TimBor Pro to protect from
	WDOs. Monitor for crawling insects with Lo-Line
	sticky traps placed at the floor/wall junction on both
	sides of entry doors. Set Victor mouse snap traps in
	food area & check daily, then reset. Rake organic
	material (leaves, etc.) from under structure. Remove
	all vegetation to .91 m (3 ft) from structure. Install a
	.91 m (3 ft) wide gravel barrier around the structure.

Outbuildings, William Floyd Estate	
Inspection Findings	Recommended Actions
Inside, Staff F	Housing Unit 1
Left unit of duplex has substantial clutter; kitchen stove very greasy & ants observed in kitchen	Thoroughly clean this unit & eliminate clutter (pest harborage). Thoroughly clean kitchen stove after each use. Monitor for crawling insects with Lo-Line sticky traps
Inside, Staff F	Housing Unit 2
Right unit of duplex has some clutter in the middle	Thoroughly clean this unit & reduce clutter. Install
front bedroom; spider webs observed; dead <i>Harmonia</i> lady beetles & spider webs observed in back bedroom; & a gap under the front door	door sweep on front door. Remove spider webs & dead lady beetles. Monitor for crawling insects at floor/wall junction on both sides of exit doors with Lo-Line sticky traps
Outside, Staff I	Housing 1 and 2
The Sentricon system has been installed around the duplex; carpenter bee nest holes observed in wood trim; wood rot observed in white uprights. A bird nest is on the corner security light; an ant trail was observed going up under the siding by the kitchen of Unit 2. A paper wasp nest was present under the eave; organic matter present under decks; the concrete basement has clutter, spider webs, dust & dirt; the laundry room needs cleaning.	Contractor should monitor Sentricon system monthly. Carpenter bee holes can be treated with DE or TimBor Pro, then sealed with a hardwood dowel. Wood rot can be treated with BoraCare or TimBor Pro. Remove the bird nest. Treat ants outside with Drax Liquidator bait station. Remove wasp nest after hard freeze. Rake out organic material under decks & discard. Wood decks can be treated with BoraCare or TimBor Pro to prevent WDOs. Clean & rearrange basement (remove clutter
The Carr	iage Barn
Outside walls have wood rot. Top board at roof line is broken. WDO damage in beams & walls. Leather tack damaged. Mouse droppings present &bird nests on beams. Spider webs present. The carriages are quite dirty & the upholstery is greatly deteriorating. Rodent activity observed. Old furniture damaged. Powderpost beetle damage & frass from beams on stored objects. Open structure provides easy access to vertebrate & arthropod pests.	Repair broken wood portions. Treat entire structure with BoraCare or TimBor Pro to protect wood from WDOs. Clean & oil leather material. This open structure is unable to exclude vertebrate or arthropod pests. Set Victor snap traps for rodents. Remove important historic material & store in pest-free, secure storage facility. Repair structure using sound wood (treated) & historic methods to prevent arthropod & vertebrate pest access into the structure. Prune back overhanging or adjacent vegetation to at least .91 m (3 ft) from structure. Thorough cleaning of the Carriage Barn & its contents is a high priority.
Wood	Shed
Wooden structure has extensive WDO damage from powderpost beetles & carpenter ants. The structure is open & has a dirt floor. Animal gnawing on uprights is present. Ant-lion cones in the dirt floor help reduce ants.	Treat the entire wood structure (except firewood) twice with BoraCare or TimBor Pro to prevent WDOs.

Recommended Actions	
House	
Repair roof of structure to exclude vertebrates with 1/4	
in. hardware cloth, or close fitting wood roof & side	
walls. Treat all exposed wood twice with BoraCare or	
TimBor Pro to prevent mold, wood rot or other	
WDOs.	
ge Crib	
Thoroughly clean stored material. Repair structure to	
prevent vertebrate & arthropod access. Treat all	
exposed wood with BoraCare or TimBor Pro to	
prevent WDO damage. Remove leaves & other	
organic material from beneath the Storage Crib.	
Carpenter ants observed. Stored material dirty. Old Shop	
Thoroughly clean the structure. Repair all holes,	
cracks & crevices with historic material or Stuf-Fit and	
1/4 in. hardware cloth. Install door sweeps. Treat all	
exposed wood twice with BoraCare or TimBor Pro.	
Place fine-tuned mouse traps at the floor/wall junction	
& check daily to remove dead mice & reset. Continue	
monitoring for crawling insects with Lo-Line sticky	
traps.	
n Crib	
Thoroughly clean the corn crib. Treat the entire	
structure twice with BoraCare or TimBor Pro. Remove	
all vegetation & organic debris under the structure.	
Install 2.54 cm (1 in) gravel under crib to reduce	
moisture.	
arn	
Treat all wood portions of the barn twice with	
BoraCare or TimBor Pro. Remove bird and wasp	
nests. Clean all machinery exhibited.	
Barn	
Thoroughly clean the New Barn & contents. Treat all	
wood twice with BoraCare or TimBor Pro. Remove all	
bird, wasp & mud dauber nests. Remove organic	
material & reduce moisture (rock gravel).	
Gazebo	
Remove nests. Treat entire structure twice with	
BoraCare or TimBor Pro.	

Outbuildings, William Floyd Estate	
Inspection Findings	Recommended Actions
	r Shed
Wood rot in fascia. Large hole in front. Evidence of	Thoroughly clean to remove rodent & insect
rodents.	droppings. Treat entire structure twice with BoraCare
	or TimBor Pro. Repair holes in structure with ¼ in.
	hardware cloth or Stuf-Fit. Replace fascia with borate-
	treated wood & paint with quality oil-based paint.
	cshop
Gap under doors. Spider webs present. Shingles	Install door sweeps on doors. Replace shingles &
missing. Knot holes are open. Moss on north side	repair holes. Remove moss & prune vegetation back at
siding. Vegetation too close to building.	least .91 m (3 ft) from structure. Treat all wood twice
	with BoraCare or TimBor Pro. Install .91 m (3 ft) by
	15.24 cm (6 in) deep gravel barrier around the
	workshop.
	prage Shed
Open wood structure cannot exclude pests. Carpenter ant & inchworm observed.	Treat all wood twice with BoraCare or TimBor Pro.
Fuel Storage & Fin	re Cache Buildings
These structures were locked.	Treat all wood twice with BoraCare or TimBor Pro.
Collection Sto	orage Building
Cockroaches reported; oriental cockroaches observed	Replace back door sweep. Thoroughly clean entire
in garbage. Spiders, sow bugs, crickets, beetles &	storage building. Place Lo-Line sticky traps at the
carpenter ants captured in sticky traps. Live spiders &	floor/wall junction & on shelving throughout building.
webs between cabinets. Dermestid beetles & larvae,	Monitor weekly. Replace traps when mostly filled.
clothes moth, psocids, predacious ground beetle & an	Place pheromone traps for clothes moth & dermestid
insect cocoon observed. Back door sweep damaged.	beetle adults high in the inside corners of the building
	& check for captures weekly. Flying insect captures
	tell which sector to search for larval activity. Treat all
	cracks & crevices with DE or DOT, then caulk.
77.7	n Room
Crickets, isopods (sow bugs), spiders & webs, adult	Thoroughly clean the isolation room daily. Continue
varied carpet beetles observed. Most were found in	to monitor for crawling insects with Lo-Line sticky
sticky traps.	traps & check them daily. Caulk all cracks & crevices
	after treating them with DE or DOT.
	n Storage Building
Swallow nest over light. Mud dauber nest near roll-up	Remove swallow & mud dauber nests. Treat all wood
door. Carpenter ants by back door along with wood rot	twice with BoraCare or TimBor Pro. Refasten loose
at ground level. Loose board on west side. Old boat	plank. Turn the old boat over to eliminate standing
filled with water & mosquitoes.	water. Rake leaves away from building. Install .91 m
	(3 ft) wide, 15.24 cm (6 in) deep gravel for no-
	vegetation zone around the building. Mount outside
	lights on poles at least 9.15 m (30 ft) away to attract
	night-flying insects away from building. Install a bat
	house to reduce night insects.

Headquarters Facilities - 2005

Inspection Findings	Recommended Actions
General Observations	
Pipe holes through floor with chewing evidence.	Thoroughly clean entire office complex, kitchen &
Mouse droppings on desks, in floor registers &	restrooms. Fill pipe holes with Stuf-Fit or historic
openings behind doors. Excess clutter. Droppings &	material. Set Victor mouse traps & monitor each
chewed candles & food packets in kitchen drawers.	morning (daily) to remove captures & reset traps. Each
Holes under the sink, behind stove, by radiator, above	employee using the kitchen is responsible for cleaning
windows, in lower cabinet & under dining area door.	up after themselves. Custodial staff are responsible for
Mouse droppings under the stove broiler, behind	cleaning floors & emptying trash containers each
refrigerator, microwave & on top of cabinet shelf.	evening. Floor registers & ducts also need thorough
	cleaning.

Headquarters Facilities - 2006

Inspection Findings	Recommended Actions
Superintendent's Office	
Ceiling tiles displaced which may provide arthropod	Replace or reseal tiles, reduce clutter, monitor for
or vertebrate access. No evidence of rodent or insect	crawling insect pests.
pests observed.	
Superintendent's	Secretary's Office
No evidence of rodent or insect pests observed.	Monitor for crawling insect pests with Lo-Line sticky
	traps at the floor/wall junction.
Reception	ist's Office
There is a hole into the wall below & to the right of	Seal the hole with Stuf-Fit & replaster. Set a Victor
the front window. The floor register & duct between	snap trap in the floor register & check each morning to
the desk & the typing table has mouse droppings &	remove captures & reset. Clean register & duct.
debris.	
Utility Room	
Observed a hole in the ceiling. Dust, dirt, debris &	Repair the hole. Thoroughly clean this area & remove
clutter present. A 10.16 cm (4 in) pipe going	or organize the clutter. Cap or grate the pipe. Fill the
underground is open. The copper pipe through the wall	gap around the copper pipe with Stuf-Fit & caulk.
has surrounding space for pest entry.	Surplus, remove or discard stashed material.
Administrator's, Deputy Superintendent's, Facilities Officer's, Michelle's Offices	
No evidence of insect or rodent pests present. Some	Thoroughly clean, vacuum & organize the small
clutter, dust, minor dirt present.	amount of clutter.
Chief Rang	ger's Office
Old mouse droppings present.	Thoroughly clean this area. Set Victor mouse traps at
	the floor/wall junction & monitor daily to empty &
	reset traps. Monitor for crawling insect activity with
	Lo-Line sticky traps at the floor/wall junction.
Danielle's Office	
Wire hole in the corner by the door.	Fill & caulk hole.
Chief of Resource N	Ianagement's Office
No evidence of arthropod or vertebrate pest presence	Continue monitoring for crawling insects with Lo-
observed.	Line sticky traps

Headquarters Facilities - 2006

Inspection Findings	Recommended Actions
Chief of Interpretation's Office	
Substantial clutter present. Outside door has wood rot.	Organize or remove clutter to eliminate pest
1	harborage. Replace rotted wood or treat with BoraCare
	or TimBor Pro.
Second F	Floor Bath
Faucet leaking into the tub. No other evidence of pests	Repair the leaking faucet.
present.	
Outside, Headquarters Building	
Substantial moisture accumulation around building.	Install a 15.24 cm (6 in) deep, .91 m (3 ft) wide gravel
The decorative lath grid is damaged & open to	barrier completely around the building. Repair the lath
vertebrate pests. Tree & ornamental branches contact	grid & back it with ¼ in. hardware cloth to prevent
the structure. Leaves & other organic debris under the	access by rodents. Prune tree & shrub branches back to
steps & deck. Wood rot on the arch over the river-side	at least .91 m (3 ft) from structure. Rake out organic
door.	material from under steps & deck. Replace rotted
	wood and/or treat with BoraCare or TimBor Pro.
·	quarters Annex
Tree branches overhang & touch the roof. A hole	Prune branches back at least 1.83 m (6 ft) from the
behind the downspout by the gas meter provides	roof. Fill the hole with Stuf-Fit & caulk. Install a 15.24
access to the inside.	cm (6 in) deep, .91 m (3 ft) wide gravel no-vegetation
	zone around the building.
	uarters Annex
The west-side furnace room has wood shavings &	Thoroughly clean the entire building. Remove
detritus. Old mouse droppings are present by the south	droppings & set Victor mouse traps at the floor/wall
door. There is a hole in the west wall of the main	junction on both sides of the south door. Fill the hole
section into the furnace room. Access to below the	with Stuf-Fit & seal it with cement.
structure observed at the floor/wall junction by the	
right corner of the south door.	

ratchogue Maintenance Pacifities		
Inspection Findings	Recommended Actions	
Chief of Maintenance's Office		
No evidence of pests present.	Thoroughly clean this area. Continue to monitor for	
	insects with Lo-Line sticky traps.	
Next Office (Burch)		
Dust, dirt present. No evidence of rodent or insect	Thoroughly clean this area. Continue to monitor for	
pests.	crawling insects with Lo-Line sticky traps.	
Conference Room		
Spider webs present under grey cabinet. No evidence	Thoroughly clean this area. Use a Webster or vacuum	
of vertebrate pests present.	for spider webs. Continue monitoring for arthropods	
	with Lo-Line sticky traps.	
Open Administrative Area		
No evidence of arthropod or vertebrate pests present.	Thoroughly clean this area. Continue monitoring for	
	crawling arthropods with Lo-Line sticky traps.	

r atchogue Maintenance Pacinties	D 1.1 A .'	
Inspection Findings	Recommended Actions	
	Office	
Dust, dirt & substantial clutter, providing harborage	Thoroughly clean this area. Organize or remove clutter	
for insects & other pests. There was not evidence of	to eliminate pest harborage & enable inspection.	
insect or rodent pests present.	Continue monitoring for crawling arthropods with Lo-	
	Line sticky traps.	
Office South of	Barrera's Office	
Substantial amount of clutter present. Spider webs	Organize or remove clutter. Remove spider webs with	
(with captured insects) between wall & file cabinet.	a Webster or vacuum. Thoroughly clean this area.	
	Continue to monitor with Lo-Line sticky traps.	
Daniel Barr	era's Office	
There was no evidence of rodent or insect pest	Thoroughly clean this area. Continue to monitor with	
presence.	Lo-Line sticky traps.	
IPM Coordinator's Office		
There was no evidence of either rodent or insect pests	Thoroughly clean this area. Continue to monitor with	
present.	Lo-Line sticky traps.	
Office Area Outside IPM Coordinator's Office		
There was no evidence of pest presence here.	Thoroughly clean this area. Continue to monitor with	
There was no evidence of peaceprosence from	Lo-Line sticky traps.	
R	ath	
Old Raid Kill Ant Bait at the back edge of the shower.	Remove the old ant bait. Thoroughly clean this area.	
No evidence of pest presence.	Continue monitoring for crawling arthropods with Lo-	
Two evidence of pest presence.	Line sticky traps.	
Kita	chen	
Spider webs behind the refrigerator. A Raid Kill Ant	Thoroughly clean this area. Remove & properly	
Bait found behind the toaster oven. Dust, dirt, crumbs	discard the Raid Kill Ant Bait. Continue to monitor for	
present. crawling insects with Lo-Line sticky traps. West Side Office by Exit		
There was no evidence of pest presence.	Thoroughly clean this area. Continue monitoring with	
There was no evidence of pest presence.	Lo-Line sticky traps.	
Dook Ev	xit Door	
The back door has a gap on the hinge side.	Install a felt weather strip and/or door sweep if	
A	necessary to close the gap.	
Outside Building		
The Sentricon system has been installed to monitor for	The contractor should monitor the Sentricon system	
eastern subterranean termite presence. Attic vents	every month. Rescreen the attic vents with ½ in.	
screened with ½ in. hardware cloth. The alcove around	hardware cloth. Seal the alcove bottom with ¼ in.	
the concrete buttress is open at the bottom.	hardware cloth to prevent vertebrate entry.	
Boardwalk		
Goose droppings on the boardwalk pose a health	Power wash the boardwalk each morning.	
hazard.		

Tatenogue Maintenance Facilities		
Inspection Findings	Recommended Actions	
	-B Warehouse	
North side downspout directs water into the	Redirect downspout water away from the warehouse.	
warehouse. Holes between cinderblock at ground	Fill holes with Stuf-Fit and seal with cement. Seal	
level. Board at roof line has gaps. Vertical boards	gaps in boards at roof line. Repair or replace damaged	
damaged by wood rot. The east side had no evidence	siding. Treat all wood in the structure twice with	
of either rodent or insect pests, or wood rot organisms.	BoraCare or TimBor Pro to prevent wood rot and	
The south side had holes at the top of the block that	wood borers (WDOs). Fill all holes in block with Stuf-	
extend to inside.	Fit, then grout with cement.	
Inside PMF-	B Warehouse	
Pigeons were reported to roost inside the warehouse.	Keep doors closed when not loading or unloading	
None were observed during inspection.	material.	
The kitchen is new & clean. The stove is clean. There	Thoroughly clean this area. Continue monitoring for	
is no evidence of rodent or insect activity present.	crawling arthropods with Lo-Line sticky traps.	
The bath had no evidence of insect or rodent activity	Thoroughly clean this area. Continue monitoring for	
present.	crawling arthropods with Lo-Line sticky traps.	
.	Panel Room	
Found three tripped mouse traps. Mouse droppings	Thoroughly clean this area. Set fine-tuned Victor snap	
present.	traps with chunky peanut butter bait. Check traps daily	
	to remove captures & reset.	
Electric	al Room	
Dust, dirt & clutter. No evidence of rodent or insect	Thoroughly clean this area. Remove or organize	
activity observed.	clutter. Continue to monitor with Lo-Line sticky traps.	
•	cshop	
Dust, dirt, old rat droppings present.	Thoroughly clean this area. Set fine-tuned Victor rat	
11 0 1	traps at the floor/wall junction. Monitor traps daily to	
	remove captures & reset. Continue to monitor for	
	crawling insects with Lo-Line sticky traps.	
Mosqu	ito Lab	
Very clean. No evidence of pest presence.	Continue thorough cleaning. Continue monitoring for	
7	crawling arthropods with Lo-Line sticky traps.	
Paint	Room	
Spiders & webs seen. Rodent droppings under the blue	Thoroughly clean this area. Remove spiders & webs	
cabinet.	with a Webster or vacuum. Set Victor snap traps at	
	the floor/wall junction & monitor daily to remove	
	captures & reset. Continue monitoring with Lo-Line	
	sticky traps.	
File Stora	age Room	
No evidence of rodent or insect activity observed.	Thoroughly clean this area. Continue to monitor for	
·	crawling arthropods with Lo-Line sticky traps.	
Hall Closet		
No evidence of pest activity observed.	Thoroughly clean this area. Continue monitoring for	
	crawling arthropods with Lo-Line sticky traps.	
Middle Office		
Office neat & clean. No evidence of pest presence.	Continue to thoroughly clean this area & monitor for	
	crawling arthropods with Lo-Line sticky traps.	
	1	

Inspection Findings	Recommended Actions	
	East Side PMF-B Front Office	
Substantial clutter. No evidence of pest activity	Remove or organize clutter. Thoroughly clean this	
observed.	area. Continue monitoring for crawling arthropods	
DME D	with Lo-Line sticky traps.	
	Library	
Tripped mouse snap trap. No evidence of vertebrate or	Thoroughly clean this area. Fine-tune & reset Victor	
arthropod pests observed.	mouse traps & check daily to remove captures & reset.	
E (C'1 DME	Continue monitoring for crawling arthropods.	
	B Second Office	
No evidence of pest activity observed.	Thoroughly clean this area. Continue monitoring for	
DI III DI II C	crawling arthropods with Lo-Line sticky traps.	
	ment Ranger's Office	
Spider webs observed. Unbaited mouse traps.	Remove webs with a Webster or vacuum. Thoroughly	
	clean this area. Fine-tune, bait & set Victor mouse	
	traps at the floor/wall junction & monitor daily to	
	remove captures & reset. Continue monitoring for	
DME D I 1	crawling arthropods with Lo-Line sticky traps.	
	e Architect's Office	
Reportedly a hole in the southeast corner (behind	Move furniture & repair hole with Stuf-Fit.	
furniture). No evidence of pest activity observed.	Thoroughly clean this area. Continue monitoring for	
	crawling arthropods with Lo-Line sticky traps.	
PMF-B Holly Houser's Office		
No evidence of pest activity observed.	Thoroughly clean this area. Continue monitoring for	
DIVER O	crawling arthropods with Lo-Line sticky traps.	
	set by Holly's Office	
Tripped mouse trap. Dust, dirt & spider webs present.	Thoroughly clean this area. Remove webs with a	
No other evidence of pest activity observed.	Webster or vacuum. Continue monitoring for crawling	
DIVE D	arthropods with Lo-Line sticky traps.	
	Varehouse	
Doors seal well & prevent pest access. Several rooms	Thoroughly clean this area. Set fine-tuned Victor rat or	
were locked. Warehouse was very dusty with	mouse traps on both sides of walk-in & pull-up doors	
substantial clutter. Old rodent droppings & spider	at the floor/wall junction. Remove or organize clutter.	
webs observed. Old rat droppings in weight room.	Seal all holes with Stuf-Fit & back with ¼ in.	
Upper storage levels have substantial clutter. Holes	hardware cloth.	
through the middle bay wall.	Room	
Outside: Wood rot on A/C frame & south window		
frame.	Outside: Replace wood frames, then treat twice with	
	BoraCare or TimBor Pro. Then paint with quality oil-	
Inside: Spider webs, old rodent droppings in utility	based paint. Inside: Pamove spider webs with a Webster or	
closet. Gap around gas pipe. Microwave quite dirty.	Inside: Remove spider webs with a Webster or	
Bath has dirt in corners & spider webs under sink.	vacuum. Thoroughly clean the area. Clean the microwave. Scrub floor/wall junction & corners in	
	_	
	bath.	

Inspection Findings	Recommended Actions
Mechanic's Shop	
Carpenter bees working under NPS arrowhead over	Locate carpenter bee gallery holes & inject DE or
the door. Gap under doors allows water & pest entry.	TimBor Pro to kill bee larvae. Install door sweeps on
Vine growing into storage closet. Substantial clutter	doors. Remove vine. Thoroughly clean the entire
present. Upstairs area has substantial clutter. Metal	machine shop. Remove or organize clutter. Set fine-
trash cans stored outside had rain water exposed;	tuned Victor rat & mouse traps at the floor/wall
mosquito eggs & larvae observed.	junction & monitor daily to remove captures & reset.
	Empty water from trash cans to prevent mosquito
	breeding sites.

Otis Pike High Dune Wilderness

Inspection Findings	Recommended Actions
Visitor Cer	nter Outside
Mold/mildew present on wood planks. Animal access	Treat wood with BoraCare or TimBor Pro to prevent
under rusted roll-up door. Hardware cloth on NE side	mold, mildew & other WDOs. Deter animal access
not effective. North side behind detour sign is open to	under roll-up door by installing a close-fitting
inside. NW corner & south side have gaps.	threshold and/or replace door. Replace or refasten 1/4
	in. hardware cloth. Use Stuf-Fit secured with ¼ in.
	hardware cloth to fill gaps.
Visitor Cent	ter Basement
Several rat traps tripped (no captures). Ketch-all trap	Fine-tune Victor rat traps & bait with chunky peanut
had dead animals inside. Raccoon scat present. Water	butter; reset & monitor daily to remove captures.
leak under hot water heater. Two very young raccoon	Thoroughly clean this area. Remove or organize
kits in the corner next to hot water heater. Multiple	clutter. Repair water leaks. Close holes with Stuf-Fit
holes into the basement.	& seal with ¼ in. hardware cloth. When raccoon
	female & kits leave basement, seal all entry points.
Visitor Center In	side, Main Level
Office had spider webs & dirt under desks & cabinets.	Thoroughly clean this area, especially floor/wall
Chewing marks on several items. No other evidence of	junction, corners & under desks & cabinets. Remove
pests observed. Restrooms have dirt & sand in corners.	spider webs with a Webster or vacuum. Set Victor
Closet locked.	mouse traps near chewing evidence. Continue to
	monitor for crawling arthropods with Lo-Line sticky
	traps.
	side, Upper Level
Spider webs & dead flies. Crickets had been seen.	Repair leaks. Thoroughly clean this area. Continue to
Water leaks occur.	monitor for crawling arthropods with Lo-Line sticky
	traps.
Wilderness East	
Invasive plants observed and ID'd by Mary Laura	Move swallow nest boxes farther away from human
Lamont. GPS coordinates taken by the park IPM	activity near the Visitor Center.
Coordinator. The following plants listed: multiflora	Multiflora rose: cut at soil line & treat stumps with
rose, oriental bittersweet, autumn olive. English	Glyphosate or Triclopyr; mow or prune frequently (6
sparrows in tree swallow nest boxes.	times per growing season for 4 years).

Otis Pike High Dune Wilderness

Inspection Findings	Recommended Actions
Wilderness East (cont'd)	
	Autumn olive: early spring hand pull; cut & treat with
	Glyphosate or Triclopyr.
	Oriental bittersweet: hand pull roots before fruiting;
	cut stem & treat with Glyphosate or Triclopyr.
Old Inlet	
Substantial population of healthy phragmites.	Cut & treat stumps with Glyphosate or Triclopyr.
	Treat entire area.

Lighthouse

Inspection Findings	Recommended Actions
Pigeons ir	n Portholes
Reported to FIIS IPM Coordinator that pigeons	Clean portholes to remove nesting & fecal material.
nesting in portholes are a problem.	Use ¼ in. hardware cloth cut at least 2.54 cm (1 in)
	larger than the diameter of the porthole. Force
	hardware cloth into the portholes from the inside-out
	toward the outer edge.
Second Floor L	ifesaving Room
No evidence of pest activity observed.	Thoroughly clean this area. Continue to monitor for
	crawling arthropods with Lo-Line sticky traps.
Second Floor S	hipwreck Room
No evidence of pest activity observed.	Thoroughly clean this area. Continue to monitor for
	crawling arthropods with Lo-Line sticky traps.
Second Floor Main Hallway	
No evidence of pest activity observed.	Thoroughly clean this area. Continue to monitor for
	crawling arthropods with Lo-Line sticky traps.
Second Floor	r Main Office
Substantial clutter present; dust, dirt & detritus under	Thoroughly clean this area. Remove or organize
& behind cabinets, under desks, etc. No evidence of	clutter. Continue to monitor for crawling arthropods
pest activity observed.	with Lo-Line sticky traps.
Second Flo	oor Closets
No evidence of pest activity observed.	Thoroughly clean this area. Continue to monitor for
	crawling arthropods with Lo-Line sticky traps.
Second Floor	Center Office
Substantial clutter present. No evidence of pest	Remove or organize clutter. Thoroughly clean this
activity observed.	area. Continue to monitor for crawling arthropods with
	Lo-Line sticky traps.
Second Floor Conference Room & Closet	
No evidence of pest activity was observed.	Thoroughly clean this area. Continue to monitor for
	crawling arthropods with Lo-Line sticky traps.
Second Floor Kitchen	
Rodent hole next to entry. Dead flies present. Mouse	Thoroughly clean this area. Remove the Tin Cat.
droppings under the register. Dirt under the range top.	Repair hole with Stuf-Fit & seal with 1/4 in. hardware
A "Tin Cat" was present.	cloth. Clean the range top.

Lighthouse

Lighthouse	
Inspection Findings	Recommended Actions
Second F	Floor Bath
Mold present in the shower. No other evidence of pests observed.	Thoroughly clean this area. Continue to monitor for crawling arthropods with Lo-Line sticky traps. Clean mold area with a fungicidal cleaner. Increase ventilation to dry out the bath.
First Floor Gift	Shop & Closet
Dust & dirt behind shelves & displays. No evidence of pest activity observed.	Thoroughly clean this area. Continue to monitor for crawling arthropods with Lo-Line sticky traps.
First Floor	Restrooms
No evidence of pest activity observed.	Thoroughly clean this area. Continue to monitor for crawling arthropods with Lo-Line sticky traps.
First Floor Ja	nitorial Closet
No evidence of pest activity observed.	Thoroughly clean this area. Continue to monitor for crawling arthropods with Lo-Line sticky traps.
	Main Hallway
No evidence of pest activity observed.	Thoroughly clean this area. Continue to monitor for crawling arthropods with Lo-Line sticky traps.
There is a leak over the tower entrance archway. Wood rot is present in window frames.	Repair the leak in the archway. Repair or replace window frames. Treat wood with BoraCare or TimBor
	Pro; then paint with quality oil-based paint to match.
First Floor No	ortheast Room
Well-designed displays. Trash under registers. Spider webs on both sides of TV monitor & on the fireplace. No other evidence of pest activity observed.	Remove webs with a Webster or vacuum. Thoroughly clean this area. Continue to monitor for crawling arthropods with Lo-Line sticky traps.
First Floor	Radio Room
Substantial clutter present. Several holes in the ceiling. Spider webs observed. No other pest activity observed.	Remove or organize clutter. Repair holes in ceiling with Stuf-Fit & seal with cement. Remove webs with a Webster or vacuum. Thoroughly clean this area. Continue to monitor for crawling arthropods with Lo-Line sticky traps.
Base	ement
Dead crickets & other insects at floor-wall junction. An OTC pesticide was found on a shelf. The southwest room has moisture evident. Moisture found around Bilco door. Mold present on refrigerator gaskets. Pipe holes up to the level above have gaps. There was no other evidence of vertebrate or arthropod pests present.	Remove the pesticide container & properly dispose of it. Thoroughly clean this area. Continue to monitor for crawling arthropods. Treat cracks & crevices or voids with Niban-FG, Nibor-D or Perma-Guard Commercial Insecticide for crickets & other arthropods. Repair water leaks. Improve air circulation to reduce humidity. Clean refrigerator gaskets. Fill pipe hole gaps with Stuf-Fit & seal with cement. Remove or organize clutter.
	e Shop Southeast Room
Pipe holes through wall with gaps. No evidence of pest activity observed.	Fill pipe holes around pipes with Stuf-Fit & seal with mortar. Thoroughly clean this area. Continue monitoring for crawling arthropod pests with Lo-Line sticky traps.

Lighthouse

Inspection Findings	Recommended Actions
Basement Generator Room	
Pipe holes through wall. Air & moisture entering through the Bilco door on north side. No evidence of pest activity observed.	Fill holes around pipes with Stuf-Fit & seal with mortar. Seal Bilco door with weather strips to prevent moisture. Thoroughly clean this area. Continue to monitor for crawling arthropods with Lo-Line sticky traps.

Lighthouse Annex

Inspection Findings	Dagamman dad Astiana	
Inspection Findings	Recommended Actions	
	ters 1	
Vacant. Dust, dirt & sand present, especially in	Thoroughly clean this area. Continue to monitor for	
corners.	crawling arthropods with Lo-Line sticky traps.	
Quar	ters 2	
Vacant. Dust, dirt, spider webs & debris under	Thoroughly clean this area. Remove webs with a	
registers.	Webster or vacuum. Remove trash from under	
	registers. Continue to monitor for crawling arthropods	
	with Lo-Line sticky traps.	
Quar	ters 3	
Occupied. Dust, dirt, sand, insects & debris under	Thoroughly clean this area. Repair moisture leak &	
registers. Moisture damage & peeling paint on ceiling.	repaint with quality oil-based paint. Continue to	
	monitor for crawling arthropods with Lo-Line sticky	
	traps.	
Quarters 4		
Occupied. Clean. Dust bunnies under bed. Spider	Thoroughly clean this area. Remove webs with a	
webs under sink in bath; webs under heat register & at	Webster or vacuum. Continue to monitor for crawling	
back door. No other evidence of pests observed.	arthropods with Lo-Line sticky traps.	
	y Room	
Hole in the wall. Trash behind washer. Incorrectly set	Occupants responsible for thoroughly cleaning this	
mouse traps.	area. Repair hole with Stuf-Fit & seal with mortar.	
1	Remove trash. Continue to monitor for crawling	
	arthropods with Lo-Line sticky traps.	
Rear Restroom		
Spider webs & insect parts under toilet.	Thoroughly clean this area. Remove webs with a	
spraer wees a miseet parts under tones.	Webster or vacuum. Continue to monitor for crawling	
	arthropods with Lo-Line sticky traps.	
Kitchen/Lounge		
Gap around drain pipe under sink. Dirt & grime under	Fill gap around pipe with Stuf-Fit & seal with plaster	
range top & under broiler drawer. No screens on the	(spackle). Thoroughly clean this area. Clean under	
back windows.	range top & below broiler. Install screens on the back	
ouch williams.	windows. Continue to monitor for crawling arthropods	
	with Lo-Line sticky traps.	
Fara	Cats	
Feral cats present. Possible source of cat fleas,	Feral cats feed on mice only if they are not being fed	
distemper & other diseases.	by occupants.	
distemper & other diseases.	by occupants.	

Lighthouse Annex

Lighthouse Annex		
Inspection Findings	Recommended Actions	
Large Upstai	rs Apartment	
Occupied. Clean. Cat food present under stove. Rust	Thoroughly clean this area. Remove or organize	
present on bathroom ceiling. Clutter in office. No	clutter. Continue to monitor for crawling arthropods	
evidence of pest activity observed	with Lo-Line sticky traps, placed between appliances	
	& walls (to prevent capturing cats).	
Small Upstai	rs Apartment	
Occupied. Ants report in kitchen & bedroom where	Follow ant trails to entry point & seal entry with caulk.	
cracks occur. Mold in refrigerator door gaskets. Hole	Clean ant trail with soapy water to remove pheromone.	
around pipe under sink. Dirt & grime under stove	Remove webs with a Webster or vacuum. Fill gas pipe	
range top & under broiler drawer. Spider webs present.	gap with Stuf-Fit & seal with mortar. Remove mold.	
Gap around gas pipe by washer. Mold around bathtub.	Thoroughly clean this apartment. Continue monitoring	
	with Lo-Line sticky traps.	
First Floor Radio	Transmitter Room	
Dirt, clutter & spider webs present. Old radio	Repair hole in wall with Stuf-Fit & seal with mortar.	
equipment stored. Hole at the bottom of the double	Apply door sweeps to double doors. Thoroughly clean	
doors. Hole in wall.	this area. Continue to monitor for crawling arthropods	
	with Lo-Line sticky traps.	
Middle Ra	nger Office	
Holes in wall under heat register. Substantial clutter	Repair holes with Stuf-Fit & seal with mortar. Remove	
present. No evidence of pest activity observed.	or organize clutter. Thoroughly clean this area.	
	Continue to monitor for crawling arthropods with Lo-	
	Line sticky traps.	
Front Ran	ger Office	
Clutter present. Hole under corner of outside door &	Remove or organize clutter. Thoroughly clean this	
access under inside door. Mold in refrigerator/freezer.	area & refrigerator. Repair hole by door with Stuf-Fit	
Refrigerator dirty. Dermestid beetle larvae & frass in	& seal with mortar. Replace window screen. Remove	
stuffed owl. Screen missing in bathroom window. An	OTC pesticide. Install door sweep if necessary or raise	
OTC pesticide in bathroom.	threshold to prevent pest access under door. Place owl	
	in plastic bag & place in freezer for 2 days; allow to	
	thaw 2 days; place in freezer for 2 days; & thaw again	
_	to kill dermestid beetle larvae.	
	thouse Annex	
North side moisture leak from A/C unit (2 nd floor).	Repair moisture leak. Replace window screen. Repair	
Screen off window. Hole around electrical box with	electric box hole with Stuf-Fit & mortar. Replace	
gnawed wires. Rodent hole under back porch.	downspout outflow end. Monitor rodent hole for	
Downspout with outflow device removed. West side	activity; trap & fill hole. Prune all trees back at least	
has tree too close to structure & a small tree right	.91 m (3 ft) or more or remove trees. Remove tree	
against building. South side has sparrow nest. Rain	against building. Remove nest after young have flown.	
gutters full of pine needles.	Clean rain gutters & cover with screen.	
Maintenance Shed		
Barn swallow nests & swallows inside. Large hole in	After young have flown, exclude birds & remove	
door for swallows. Large gap under doors. Mouse	nests. Treat for mites & swallow bugs with DE as	
droppings on north side (access under west door).	needed. Repair hole in door & install door sweeps. Set	
	fine-tuned Victor snap traps baited with chunky peanut	
	butter & check traps daily. Thoroughly clean this area.	

Lighthouse Annex

Inspection Findings	Recommended Actions	
Maintenance Shed South Room		
Locked storage. Old mouse droppings. Pipe holes with	Fill gaps with Stuf-Fit & seal with mortar. Thoroughly	
gaps to outside.	clean this area. Continue to monitor for crawling	
	arthropods with Lo-Line sticky traps.	
Lighthouse Grounds		
Exotic plants observed: autumn olive, oriental	Hand pull when young. Cut at ground level & paint	
bittersweet, bunch grass, little blue stem, phragmites,	stump with Glyphosate or Triclopyr. Replant with	
& mugwort.	desired native plants.	

Sailors Haven

Inspection Findings	Recommended Actions	
Restaurant/Gif	t Shop SH-106	
Outside: Deck posts had 19-22% moisture; had been treated with preservative. Trash & debris under deck. Rodent activity signs observed under building. Loose shingles under eaves. Carpenter bee holes under eaves. Screen missing on kitchen exhaust fan. Inside: Gift shop clean & without clutter. Office had	Monitor wood posts & beams for wood rot. Remove trash & debris. Monitor for rodent activity to determine burrow or nesting sites. Set fine-tuned Victor snap traps & monitor daily. Repair shingles. Replace screen on exhaust fan. Inject DE or TimBor Pro into bee holes to kill larvae. Thoroughly clean this area. Remove debris. Continue	
sawdust on floor. Kitchen storage room & restroom clean with no clutter. Drains clean. Debris under grill & shelves.	to monitor for crawling arthropods with Lo-Line sticky traps.	
Visitor Center SH-104		
Outside: Wood rot at wood/soil interface. Stretcher storage has bird nest near tank. Hose dripping water onto wood walkway. Outdoor shower full of leaves. Plastic bags wrapped around pipes to fill gap into building. Towel storage room has musty odor. Several holes in walls. Window frame on east side has large gap into wall. Debris on back side beneath building. Large hole next to chimney. Fascia board damaged. Chimney separating from building at top. Trees too close to building. Missing shingles.	Wood at soil line may need to be replaced. Treat wood with BoraCare or TimBor Pro to prevent wood rot. Remove bird nest after young fly. Exclude birds. Remove or redirect dripping hose. Fill gaps around pipes with Stuf-Fit & seal with mortar or other material. Thoroughly clean towel room. Repair holes in walls. Repair or replace damaged window frame. Repair the chimney/building interface to prevent pest access. Prune trees back at least .91 m (3 ft) from structure or move or remove the trees. Replace broken shingles.	
Inside: Water leak by the hot water heater. Wood has high moisture levels which promote wood rot. Cleanliness of offices & front visitor area is not good. Little evidence of pest activity observed.	Repair leak. May require wood replacement. Treat wood with BoraCare or TimBor Pro. Thoroughly clean these areas. Continue to monitor for crawling arthropods with Lo-Line sticky traps. House	
Ladies' Side: Unflushed toilets. Dead insects in light fixtures. Water leaks from outside showers. Wood rot by shower entrances. Carpenter bee holes & galleries in overhead beams of showers.	Check toilets for operation. Clean out light fixtures. Repair shower leaks. Replace or treat wood with BoraCare or TimBor Pro. Treat bee holes & galleries with DE or TimBor Pro.	

Sailors Haven

Inspection Findings	Recommended Actions
Bath House	se (cont'd)
Men's Side: Unflushed toilets. No screens on inside	Check toilets for operation. Replace window screens.
window openings. Wood rot in several showers.	Replace damaged wood and/or treat with BoraCare or
	TimBor Pro.
Storag	e Shed
Mouse nests in rescue baskets & in coiled ropes in	Thoroughly clean this area. Repair holes in shed with
another basket. Many holes for rodent access.	Stuf-Fit backed by ¼ in. hardware cloth. No food
	stored in this shed. Set fine-tuned Victor mouse traps
	at the floor/wall junction. Monitor traps daily to
G. CCTT	remove captures & reset.
Staff Housing	
Occupied. Kitchen has sawdust under sink. Stove has	Thoroughly clean this apartment. Clean under range
dirt & grime under range top, oven & under broiler.	top, oven & under broiler; bathroom walls & cabinet.
Fireplace holes filled with rusted steel wool. Moisture	Repair holes by fireplace with Stuf-Fit & seal with
damage on floor of laundry room. Half bath has tile	mortar. Repair holes in floor under sink in bedroom
missing, hole in floor under sink, mold on walls & in	wall & kitchen floor. Replace fascia board. Replace deck wood & treat deck with BoraCare or TimBor Pro.
cabinet. Paint peeling on bedroom shelves & hole in wall, Hole in floor behind kitchen table. Rot in deck	
wood. Fascia board missing. Pin hole water leak under	Empty water in trash can. Replace metal fitting with pin hole leak.
deck. Water in trash can containing mosquito larvae.	pili note teak.
	Motel SH-102
Holes in laundry room floor. Dead spiders & insects.	Staff occupants must conduct cleaning & remove or
Debris on bedroom floor. Large chewed holes in	organize clutter. Fill holes with Stuf-Fit & seal with
corner of small bedroom. Mouse trap (set) with mouse	mortar. Teach occupants how to fine-tune & set mouse
droppings around it.	snap traps. Continue to monitor for crawling
2.5FF-10.00 m.s.m.s.m.	arthropods with Lo-Line sticky traps.
Maintenance	Shop SH-109
Large hole in east wall to outside; several holes	Thoroughly clean this area. Repair holes in wall and
through the floor. Mouse droppings in circuit breaker	floor. Install quality door sweeps on all outside doors.
closet. Large gaps under all outside doors. Rat	Set fine-tuned Victor rat traps on both sides of outside
droppings near door & on lower shelves.	doors. Set fine-tuned Victor mouse traps in circuit
	breaker closet. Check all traps daily for captures &
	reset. Continue to monitor for crawling arthropods
	with Lo-Line sticky traps.
	03 (Old Horse Barn)
Many spider webs. Mouse droppings in water heater	Thoroughly clean this area. Remove webs with a
closet. Separate laundry building has holes in floor.	Webster or vacuum. Set fine-tuned Victor mouse traps
Jimson weed in paddock area.	in water heater closet. Find mouse entry & perform
	exclusion. Fill holes with Stuf-Fit & seal with mortar.
	Remove Jimson weed. Monitor for new sprouts &
	remove.

Sailors Haven

Inspection Findings	Recommended Actions
Garbage House	
Construction ongoing here. Area under building	Rotted wood should be replaced & all wood treated
flooded. Sand fill to be installed. Wood rot present.	twice with BoraCare or TimBor Pro. Fill holes in
Wood moisture over 40%. Several holes in building.	building with Stuf-Fit & back (on both sides of wood)
Metal doors hav a 2.54 cm (1 in) gap at each bottom	with ¼ in. hardware cloth. Install a metal threshold to
edge. 2.54 cm (1 in) metal mesh in ceiling can't	fill gap under doors. Install ¼ in. hardware cloth over
exclude rodents.	all of the 2.54 cm (1 in) metal mesh in ceiling to
	exclude rodents. Doors must close tightly.
Sunken Forest	
Mosquito larvae in boarded cesspool along the path.	Drain the standing water. Apply mosquito dunks. Float
	oil (olive oil) on surface of water to deter mosquito
	larvae.
Exotic Invasive Plants: Japanese honeysuckle, oriental	Hand pull when young. Cut at ground level & treat
bittersweet, phragmites & spotted knapweed have	stumps with Glyphosate or Triclopyr.
been found here.	

Talisman/Barrett Beach

Inspection Findings	Recommended Actions
Concessio	n Building
Wood rot at ground level under south sliding window. Holes on north side & at ground level. Doorway on west side has cover board open through to outside. Storage room open & mouse droppings on floor.	Thoroughly clean this area. Replace wood and/or treat with BoraCare or TimBor Pro. Repair holes with Stuf-Fit backed by ¼ in. hardware cloth. Repair cover board. Seal all openings into storage room. Set fine-tuned Victor mouse snap traps at the floor/wall junction in storage room.
Restr	rooms
Restrooms were locked – no access. Hole at northwest corner of storeroom. Moisture in inner pipe race with old mouse droppings. Water leak from faucet on east side. Mold at floor/wall junction in both outside showers. Men's restroom, middle south window is open without a screen.	Repair hole with Stuf-Fit backed with ¼ in. hardware cloth. Repair leaks. Remove mold. Treat all wood with BoraCare or TimBor Pro. Replace missing screens.
	se TA-155
Inside: Old mouse droppings in broiler & behind refrigerator. Chewed hole under bathroom sink. Northeast bathroom has missing ceiling tile.	Thoroughly clean this area. Fill hole with Stuf-Fit & back with ¼ in. hardware cloth. Set fine-tuned Victor mouse traps in kitchen at the floor/wall junction & under the broiler. Check traps daily for captures & reset.
Outside: Southeast corner has holes at roof. Vegetation contacting structure. Wood rot on northeast window frame. Substantial moisture under house. Termite mud tubes & damage on piling under structure. Covered washer/dryer cabinet on porch has holes.	Repair holes. Prune vegetation back at least .91 m (3 ft) from structure. Install a 15.24 cm (6 in) deep, .91 m (3 ft) wide gravel, no-vegetation zone completely around the structure. Treat all exposed wood with BoraCare or TimBor Pro to manage WDOs. Drill &

Talisman/Barrett Beach

-155 (cont'd)
inject termite-infested pilings & beams with BoraCare
or Jecta.
House TA-154
Thoroughly clean the entire structure. Be aware of
Hantavirus exposure; disinfect all areas with droppings
or urine. Wear protective measures. Search for entry
points & install exclusion measures: Stuf-Fit, ¼ in.
hardware cloth, metal flashing, etc. Set fine-tuned
Victor snap traps & monitor daily to remove captures
& reset. Repair faucet leaks. Replace shingles & rain
gutters and downspouts.
A-153
Trap out rodents with fine-tuned Victor rat and mouse
traps. Monitor traps daily to remove captures & reset.
Demolition will force any pests present into the
surrounding areas or communities.
uilding
Repair water leak. Monitor for pests.
Shed TA-156
Replace window. Fill all holes with Stuf-Fit & back up
with ¼ in. hardware cloth. Thoroughly clean this area.
Set fine-tuned Victor mouse traps & monitor daily to
remove captures & reset. Close gaps at eaves & floor
vents with ¼ in. hardware cloth.
Plants
Garlic mustard can be hand-pulled when young.
Phragmites, tree of heaven & Japanese black pine will
require cutting at ground level & the stumps treated
with Glyphosate or Triclopyr. Replace removed exotic
plants with desired native species.

Dune Station

Inspection Findings	Recommended Actions
Visitor Display Area	
Wood rot present on walls & inside doors. Screens on	Treat all exposed wood twice with BoraCare or
louvers deteriorated. Dermestid larvae attacking	TimBor Pro. Remove mud dauber nest(s). Remove old
displayed Gannett. Paint peeling from walls. Mud	paint & repaint with quality oil-based paint. If
dauber nest at ceiling.	salvageable, treat Gannett with DE & TimBor Pro dust
	to manage dermestid larvae. Replace screens. Monitor
	for crawling arthropods.

Dune Station

Inspection Findings	Recommended Actions
EMS I	Building
Black widow spider with egg case & web over the	Thoroughly clean the area. Remove webs with a
door. Dead flies below web. Screens on louvers	Webster or vacuum. Replace screens. Continue
deteriorated. Dust, dirt & debris observed.	monitoring for crawling arthropods.
Men'	s Bath
Screens on louvers have deteriorated. Mud dauber	Replace screens. Remove mud dauber nests.
nests present.	Thoroughly clean this area. Continue to monitor for
	crawling arthropods with Lo-Line sticky traps.
Women's Bath	
Screens on louvers deteriorated. Paint peeling from	Replace screens. Remove paint & repaint with quality
walls. Shower fixture leaking.	oil-based paint. Repair shower fixture leak. Continue
	monitoring for crawling arthropods with Lo-Line
	sticky traps.
	asive Plants
Large area of phragmites between Dune Station &	Pull with a weed wrench or cut at ground level; then
Watch Hill.	treat stumps with Glyphosate or Triclopyr.
Storage Building #29 under Walkway	
Three live <i>Peromyscus</i> spp. Mice & nest observed in	Thoroughly clean this area. Be aware of Hantavirus
pump & pressure tank frame. Large gap under the	risk. Wear protective gear. Install a quality door sweep
door.	to door or raise threshold to close gap. Set fine-tuned
	Victor snap traps at the floor/wall junction & monitor
	daily to remove captures & reset.
Storage Building South of Building #29	
Long dead fox present & dermestid larvae feeding on	Remove dead fox. Thoroughly clean this area. Repair
the carcass. Broken window.	window. Continue to monitor for crawling arthropods
	with Lo-Line sticky traps.
Large leak under walkway below the drinking	Repair leaking pipe.
fountain.	

Inspection Findings	Recommended Actions
Maintenance Shop/Office Complex WH-20	
Dust, dirt & debris present. Hole in wall behind north	Thoroughly clean this area. Repair hole with Stuf-Fit
side workbench. Black widow spider & web in	& ¼ in. hardware cloth. Remove spider & web with a
northeast ceiling corner.	Webster or vacuum. Continue monitoring for crawling
	arthropods with Lo-Line sticky traps.
WH-20 Resource Management Office	
Mouse droppings & nut on floor by north wall.	Thoroughly clean this area. Remove or organize
Substantial harborage (clutter).	clutter. Set fine-tuned Victor snap traps & monitor
	daily to remove captures & reset. Find & exclude
	rodent entry points.
WH-20 Locker Room	
Lockers locked – no access. No evidence of pest	Staff responsible for cleanliness of lockers. Continue
activity observed.	monitoring for crawling arthropods.

Inspection Findings	Recommended Actions
WH-20 Front	Ranger Offices
No evidence of pest activity observed.	Thoroughly clean this area. Continue monitoring for
	crawling arthropods with Lo-Line sticky traps.
WH-20 R	Restrooms
No evidence of pest activity observed in either bath.	Thoroughly clean this area. Continue to monitor for
	crawling arthropods with Lo-Line sticky traps.
WH-20	Kitchen
Mouse droppings were abundant, especially around	Thoroughly clean this area. Replace window screen.
poorly set mouse traps & trash can. Hole in wall by	Fill hole in wall with Stuf-Fit & seal with ¼ in.
wood panel. No screen on left window. Cabinets clean	hardware cloth. Remove or organize clutter. Monitor
inside. Mouse droppings between refrigerator & the	for crawling arthropods with Lo-Line sticky traps. Set
wall. General sanitation poor. Moisture on floors.	several fine-tuned Victor snap traps for mice at the
	floor/wall junction & monitor daily to remove captures
	& reset.
	Garage
Outside: Building in good condition. Debris under	Remove debris under buildings with long-handled
building. Many poison ivy plants present. Bales of hay	rakes. Pull poison ivy or treat with Matran2. Remove
or straw under the building are decomposing & may	bales of hay/straw.
pose a fire hazard.	
Inside: Small closet has holes around pipes through	Fill gaps around pipes with Stuf-Fit & seal with ¼ in.
the wall with scattered insulation. Dust, dirt & debris	hardware cloth. Thoroughly clean this area. Set
in store room. Mouse droppings in southwest corner of	numerous fine-tuned Victor mouse snap traps at the
garage. Mouse access under roll-up door & through	floor/wall junction; monitor daily to remove captures
floor boards.	& reset. Repair holes in floor boards. Install threshold
	to close gap under roll-up door. Continue monitoring
	for crawling arthropods with Lo-Line sticky traps.
	nce Yard
A tree growing under the steps. Poison ivy abundant.	Remove the tree. Hand pull poison ivy (wear gloves
	and goggles) or treat with Matran2.
	orage Building
Broken window. No wasp or yellow jacket nests	Repair window. Install Stuf-Fit, ¼ in. hardware cloth,
observed. Animal tracks are present inside.	or other exclusion material to exclude vertebrates.
Horse Barn WH-26	
Fly sticky strips captured numerous flies. Rat	Replace fly strips as they fill with flies or dry out.
droppings on east side & in the tack area. Rodent	Thoroughly clean this area & remove rodent
activity in insulation behind saddles. Mouse activity	droppings. Fill holes, gaps, cracks & crevices with
behind refrigerator & desk in office. Insect pests	Stuf-Fit & seal with ¼ in. hardware cloth. Keep grain
observed. Substantial spilled or scattered grain & hay.	in tightly closed metal containers. Set fine-tuned
Holes, cracks & crevices present.	Victor mouse traps in office area at floor/wall junction
	& monitor daily to remove captures & reset. Set fine-
	tuned Victor rat traps at floor/wall junction where
	horses can't come in contact. Monitor traps daily to
	remove captures & reset.

Inspection Findings	Recommended Actions	
Pier Fire Sto	rage Building	
No evidence of pest activity observed.	Thoroughly clean this area. Fill all holes & cracks or crevices with Stuf-Fit & seal with ¼ in. hardware cloth. Continue to monitor for crawling arthropods with Lo-Line sticky traps & rodents with Victor snap traps.	
Visitor Center		
Dust, dirt & debris present. Moisture damage by windows.	Thoroughly clean this area. Determine moisture source & seal with caulk. Continue to monitor for crawling arthropods with Lo-Line sticky traps.	
	ar WH-18	
To be renovated at end of season. Sanitation very poor. Dust, dirt & debris throughout, especially in cracks & crevices. Large gap under the door. Copious mouse droppings. Ice machine leaks water on floor. Multiple water leaks. Trash under equipment.	Thoroughly clean this area. Repair leaks & condensation. Install quality neoprene or rubber door sweeps on doors. Raise thresholds to close gap under doors. Find rodent entry points & repair with Stuf-Fit & ½ in. hardware cloth. Set fine-tuned Victor mouse snap traps baited with chunky-style peanut butter at floor/wall junction on both sides of doors & every 3.05 m (10 ft) along walls. Monitor daily (early morning) to remove captures & reset.	
Office: Dust, dirt & debris present. Dirt behind freezer.	Thoroughly clean this area. Continue to monitor for crawling arthropods with Lo-Line sticky traps.	
Bath: Dust, dirt & debris present, especially under the sink.	Thoroughly clean this area. Continue monitoring for crawling arthropods with Lo-Line sticky traps.	
Gift Shop		
Dust & dirt present. No evidence of pest activity observed.	Thoroughly clean this area. Continue monitoring for crawling arthropods with Lo-Line sticky traps.	
Restrooms The results of the Point State of the Po		
Several spider webs & captured insects. Dust, dirt & grime present. No other evidence of pest activity observed.	Thoroughly clean this area. Remove webs with a Webster or vacuum. Continue monitoring with Lo-Line sticky traps.	
EMS :	Station	
Dust & dirt present. No evidence of pest activity observed.	Thoroughly clean this area. Continue monitoring for crawling arthropods with Lo-Line sticky traps.	
	Dockmaster's Station	
Clutter, dust & dirt present. No evidence of pest activity observed.	Thoroughly clean this area. Continue monitoring for crawling arthropods with Lo-Line sticky traps. Remove or organize clutter.	
Concessionaire's Office		
Pest access through double doors. Wood rot in northwest corner. Paint peeling on walls. Dust & dirt present.	Thoroughly clean this area. Install quality door sweeps on double doors & weather stripping on inner faces. Treat wood rot area with BoraCare or TimBor Pro or replace wood. Remove peeling paint & repaint with quality oil-based paint.	

Watch Hill			
Inspection Findings	Recommended Actions		
Staff Laundry Building			
Laundry Room: Spider webs. Rodent access under	Staff must clean up after themselves when using the		
doors. Dust, dirt, Lint & general disarray.	laundry. Remove spider webs with a Webster or		
	vacuum. Thoroughly clean this area. Install quality		
Tank Room: Spider webs & captured insects. Mouse	door sweeps on doors & raise the threshold to reduce		
droppings observed.	gaps. Fill holes with Stuf-Fit & seal with ¼ in.		
	hardware cloth. Set fine-tuned Victor mouse snap traps		
	at the floor/wall junction & monitor daily to remove		
	captures & reset.		
Staff Housing WH-1			
Occupied. Clean. Leaky faucet in kitchen. Hole around	1 2 2		
stove pipe outside. Carpenter bees present (no nest	Stuf-Fit & seal with heat-resistant caulk.		
holes observed) around eaves.			
Staff Housing WH-2			
Occupied. Substantial clutter in bedrooms. Dust, dirt	Remove or organize clutter. Thoroughly clean this		
& grime in kitchen. Wood rot observed outside on	area. Treat wood deck wood rot with BoraCare or		
upper deck.	TimBor Pro (twice), & then paint with waterproofing		
	polyurethane.		
	ilding by WH-2		
Locked – no access. West side plank wide open.	Repair siding. Fill holes with Stuf-Fit & seal with 1/4		
Numerous holes.	in. hardware cloth. Treat wood siding with BoraCare		
G 0077	or TimBor Pro.		
	Staff Housing WH-3		
Occupied. Ants in kitchen. Grime on stove top &	Thoroughly clean this area. Search & find rodent pest		
under stove top. Leaky faucet in bath. Dead insects	access into structure; fill holes with Stuf-Fit & seal		
behind dresser. Vent open to outside. Moisture	with ¼ in. hardware cloth. Determine moisture leaks		
damage to ceiling tiles in laundry. Mouse & rat	& repair. Remove mud dauber nests. Replace damaged		
droppings in attic. Moss & extensive wood rot on back	wood & beams. Treat all wood twice with BoraCare or		
deck. Beam under deck has substantial wood rot.	TimBor Pro; then paint with polyurethane. Set fine-		
Wood rot in bench on front deck seat. Holes in front	tuned Victor mouse snap traps at floor/wall junction &		
wood siding. Insect harborage under plywood on east	monitor daily to remove captures & rreset. Remove or		
side. Old mud dauber nest under east eaves. Gap under	organize clutter.		
roof. Mouse droppings in sheds. Clutter present.	l Sing WU 4		
	Thoroughly clean this area. Determine source of water		
Unoccupied. Water damage on front wall & at bottom of door. Mold beside stove. Dead insects behind stove.	Thoroughly clean this area. Determine source of water leak & repair. Clean stove. Remove bird nest. Treat all		
Old food under range top. Dust bunnies under bed.	exposed wood siding, beams & pilings with BoraCare		
Outside: Bird nest above middle window. Wood rot in	or TimBor Pro to protect from WDOs. Treat carpenter		
beam above northeast piling. Old evidence of eastern	bee galleries with DE or TimBor Pro. Find rodent		
subterranean termites on piling. Wood borer damage	access & fill holes with Stuf-Fit. Seal with ¼ in.		
to pilings. Carpenter bee nest in fascia.	hardware cloth. Continue monitoring for crawling		
to printed out host in factor.	arthropods with Lo-Line sticky traps.		
	aran op ood with no nine streng traps.		

Watch Hill		
Inspection Findings	Recommended Actions	
Staff House	sing WH-5	
Occupied. Clean. Leaky faucet in kitchen, outside	Repair all faucets & leaky pipes. Remove mold.	
pipes & outdoor shower. Mold in refrigerator gaskets.	Repair roof leaks. Install door frame to inside front	
Door framing missing with gaps to outside. Roof leak	door. Replace window screens. Thoroughly clean this	
in the living room & bathroom. Screen missing in	area. Continue monitoring for crawling arthropods	
bathroom window. West window in front bedroom &	with Lo-Line sticky traps.	
east side window by front door need screens. There is		
a gap over the back screen door to outside.		
	sing WH-6	
Occupied. Stove has food residues on top & under	Thoroughly clean this area. Remove or organize	
range top. Mold in top refrigerator gaskets & freezer.	clutter. Remove webs with a Webster or vacuum.	
Several spider webs. Mold in both showers./	Prune tree limbs at least .91 m (3 ft) from the	
Substantial clutter in south bedroom./	structure. Continue monitoring for crawling	
Outside: Carpenter bees flying. Tree limbs contacting	arthropods with Lo-Line sticky traps.	
structure. Old termite tube along beam under north		
side.		
Staff Housing WH-7		
Unoccupied. Evidence of water damage. Water heater	Thoroughly clean this area. Find & seal all gaps or	
closet open to the ground. Holes in chimney open to	openings from the outside to inside. Fill holes with	
outside. Moisture damage to floor. Mouse droppings	Stuf-Fit & seal with ¼ in. hardware cloth. Fill water-	
on stove & under kitchen sink. Gap under sink open to	filled low spots with soil & reseed. Remove mud	
outside. Mouse droppings in shower. Old mouse	dauber nest. Fasten warped panel & loose sheeting to	
droppings in the bath, the southeast bedroom, the	prevent pest access. Continue monitoring for crawling	
closet & on shelves.	arthropods with Lo-Line sticky traps.	
Outside: Low areas filled with water with mosquito		
larvae. Old mud dauber nest under eave. Warped		
paneling & loose sheeting.	. MII 0	
	sing WH-8	
Occupied Year Around. Clean. Dust behind washer &	Thoroughly clean this area. Continue monitoring for	
dryer. No evidence of pest activity observed.	crawling arthropods with Lo-Line sticky traps. Treat	
Carpenter bees seen flying & nests found.	bee galleries with DE or TimBor Pro dust.	
Staff Housing WH-9		
Unoccupied. Water damage to ceiling. Fine frass on	Thoroughly clean this area. Find water leaks & repair.	
floor from WDOs. Mold on refrigerator gaskets. Stove	Remove swallow nest after young fly. Repair front	
has old food residue on range top. Hole to outside by	door frame. Remove vine & repair planks. Replace	
back door. Mouse trap with captured remains & dead	missing storm windows. Fill gaps around pipes with	
insects present.	Stuf-Fit & seal with caulk or ¼ in. hardware cloth.	
Outside: Swallow nest above light. Carpenter bees		
flying (no nests observed). Vine growing between		
corner planks. Front door frame has gap. Storm		
windows missing. Gaps around pipes that enter		
underside of floor.		

Inspection Findings

Recommended Actions

Staff Housing WH-10

Many spider webs. Living room window screen held by duct tape. Flies on floor by window. Water heater pipes have gaps. Large gnawed hole beside closet. Mold in refrigerator, freezer & on outside gaskets. Moisture under sink. Ants on kitchen island counter. Fascia not flush with soffits. Southwest bedroom door has large gap. Bathroom sink has gap around pipe through wall. Large gap between windows in southeast bedroom. Water damage on east wall at floor/wall junction.

Outside: Lower door has gap at bottom. Screen missing from upper outside door. Wood rot on lower south fascia. The northeast corner fascia open on the end. Wood rot on southeast vertical corner board. Wood rot at base of support beams at west end of deck under house. Moss on deck. Bull thistle in front lawn.

Thoroughly clean this area. Remove webs with a Webster or vacuum. Replace broken screens. Fill gaps around pipes with Stuf-Fit & seal with caulk or ¼ in. hardware cloth. Repair holes. Repair loose or damaged fascia or other wood members. Find water leaks & repair. Install quality door sweeps to eliminate gaps under doors. Replace rot damaged wood or treat with BoraCare or TimBor Pro. Hand pull the bull thistle before seed forms.

Staff Housing WH-11

Occupied. Large hole in west wall at floor/wall junction in southwest bedroom. Southeast bedroom locked. Screens missing from windows. Water damage & mold in northwest corner. Mouse droppings on bottom shelves of hallway closet. Wood rot on wall at floor/wall junction. Gaps around pipes under kitchen sink. Kitchen stove has old food residue under range top. Fireplace damper is missing.

Outside: South fascia board with wood rot. Carpenter bees & 8 active galleries in south side fascia. Greenbrier vine growing up beneath the siding. Large hole above window on west side. Chimney separating from building. Wood rot in piling at ground level on northwest corner. Water leak at valve under house. Substantial poison ivy growing around the house.

Thoroughly clean this area. Find & fill all holes & gaps around pipes with Stuf-Fit & seal with ¼ in. hardware cloth or caulk. Replace all missing window screens. Find all water leaks or moisture damage & provide repairs. Wood beams, siding or planks with wood rot can be replaced and/or treated with BoraCare or TimBor Pro. Carpenter bee galleries can be treated with DE or TimBor Pro dust. Determine gaps that provide rodent access; fill with Stuf-Fit & seal with ¼ in. hardware cloth. Follow ant trails inside to locate entry points. Clean trails with soapy water to remove pheromones. Seal holes with caulk. An effective ant bait is "Drax Liquidator."

Staff Housing WH-12

Dead flies on floor. Mold in south refrigerator. Water damage at floor/wall junction on east wall. Gaps around pipes through east wall. Window screens broken or missing. Stove range top has mouse droppings. Northeast bedroom closet has mouse droppings. Rodent access under bottom of boarded-up south door. Water heater closet holes to outside. Mouse nest behind water heater. East bath has pipe gaps through north wall & a hole open to below. West bath has dead flies & mouse droppings behind toilet & under sink. West middle bedroom has mouse droppings behind dresser.

Thoroughly clean this area. Determine areas of moisture leaks & perform repairs. Replace all damaged or missing window screens. Find all holes or gaps that allow pest entry, fill with Stuf-Fit & seal with ¼ in. hardware cloth or caulk. Set fine-tuned Victor mouse snap traps at floor/wall junction & monitor daily to remove captures & reset. Fill low areas with soil to eliminate standing water. Replace wood rot damaged wood beams, siding or fascia, or treat with BoraCare or TimBor Pro.

Inspection Findings	Recommended Actions
Staff Housing WH-12 (cont'd)	
Outside: Substantial standing water around & under house. A gap left of front door. Several 2 x 6 beams damaged by wood rot under deck. Windows are missing outside. Sills open to inner wall. Lots of	
phragmites growing hear the house.	

APPENDIX II

Pest Profiles

MUSEUM PESTS

CLOTHES MOTH (Tineola bissolliella)



Webbing Clothes Moth

Webbing clothes moth adults are yellowish or golden colored, 1.27 cm (1/2 in) long or less, with narrow wings of about 1.27 cm (1/2 in) wingspan, and are distinguished by a tuft of fluffy, fine bronze to reddish-gold colored hairs (pompadour) on a bronze head. The wings do not have spots. Adults do not feed, but they fly to find food materials on which they lay 40 to 150 eggs, which hatch in seven to ten days. Clothing moth larvae are about 1.27 cm (1/2 in) long, light cream-colored, with a dark brown head. The larvae do not form a protective case around themselves.

Biology

The life cycle ranges from two to six months, depending upon environmental conditions. Although the adult moths are weak flyers, they are known to move over 91 m (300 ft) in distance. The males fly to find and mate with females, who generally remain in dark and dimly lit areas. Females produce eggs that are glued to potential food materials in closets or other sites where clothes or other natural fiber or animal pelts may be stored. From two to four generations per year are possible in warm, heated areas.

CASEMAKING MOTH (Tinea pellionella)

Adults are small; light brown to tan colored moths with a wing span of about 1.27 cm (1/2 in) The front wings have three dark spots and both wings have trailing edges of soft fringe. Larvae are about .94 cm (3/8 in) long and form a slightly smaller protective case (about .79 cm [5/16 in] long) around them which is made from the same material as that which they eat. They carry the case with them while feeding. Casemaking moths are general feeders on dried animal and plant proteins, dead insects and nests, animal carcasses, feathers, hair, etc.

Biology

Although adult moths prefer relatively dry conditions, 75% humidity is the most favorable condition for development of larvae. This moth prefers darkness and seeks out folds of fabric or secluded places to hide when disturbed. Rug lint and hair accumulations behind baseboards or in heating units are favored hiding places. The life cycle is about three to four months with one to two generations per year.



Casemaking Moth

DAMAGE

Clothes moths and casemaking moth adults do not feed but tend to remain close to the materials on which they developed. The adults are very attracted to and lay eggs on soiled materials of vegetable origin. The larvae are general feeders on hair, wool, fur, feathers, upholstered furnishings, piano felts and insect specimens. During feeding, the larvae leave distinctive silken trails on materials and produce round fecal pellets colored like the material being eaten. Any visual evidence of moths usually indicates a major infestation.

INDIAN MEAL MOTH (Plodia interpuntella [Hbn.])

The Indian meal moth is a major insect pest in this country. Some of its reputation comes from its increasing resistance to pesticides. The Indian meal moth is a small colorful moth about .84 cm (1/3 in) long with a brown head and thorax. The wing base is gray with the rest copper-colored with dark bands. Larvae are caterpillar-like, about 1.27 cm (1/2 in) long and cream colored with a brown head. Only a few larvae indicate an infestation. As the larvae grow they spin silken strands of webbing contaminated with excrement over the food source. Sticky traps



Indian Meal Moth

containing attractive odors or pheromones are available to

monitor the presence of adults. Indian meal moths can infest cereals and starch-containing products, such as crackers, cake mixes, pasta, dog food, and rodent bait. They are particularly attracted to nut meats, powdered milk, a number of spices, and dried fruits.



Careful inspection of incoming or

purchased goods in the quarantine area is crucial for early detection. Management depends on finding and destroying the infested items. Sticky monitoring traps can be used in a grid pattern to determine the location of the infestation. Other techniques include increased sanitation, treatment of cracks, and crevices with pesticides or heat treatment.

SAW-TOOTHED GRAIN BEETLE (*Oryzaephilus surinamensis* [L.])

The saw-toothed grain beetle is another major stored-product pest in the United States. This is a tiny, slender, dark-brown beetle that measures .25 cm (1/10 in) long. It has three ridges on the top and six fine teeth on either side of the thorax. The larvae are about the diameter of a human hair, have three pair of true legs, rest in a C shape, and resemble the larvae of the Indian meal moth.

Biology

Optimum temperature for development is $30 - 35^{\circ}\text{C}$ ($86 - 95^{\circ}\text{F}$) with fastest development in higher humidity. Saw-toothed grain beetles, however, can survive in cooler temperatures less than 16°C (60°F) and withstand cold winters which increase their time of life cycle and time for hatching. The larval period is 12 to 20 days, depending on temperature, nutrition and moisture. The adult's life span ranges up to three years with new generations produced every 30 days. As each female produces around 350 eggs, populations build quickly.



Saw-Toothed Grain Beetle

<u>Damage</u>

Saw-toothed grain beetles are best adapted to infest a wide variety of stored products containing food materials, such as cereal products (dried grain, flour, corn and corn products, hand soap containing corn or oatmeal, spices, herbs, etc.). Adults are imported in infested packages. Saw-toothed grain beetles are scavengers that readily penetrate and feed on the same materials as do Indian meal moths. They can be numerous and destroy a large amount of food or other organic material. Infestations that begin on grains may move throughout a structure to feed on any grain or starch-based material. Pesticides are usually unnecessary when infested materials can be found and discarded and cracks and crevices thoroughly cleaned.

WAREHOUSE BEETLES Trogoderma variabile

Adult warehouse beetles are brownish-black, about .30 cm (1/8 in) long and can fly. The larvae range up to .64 cm (1/4 in) long and vary from yellow-white to dark brown in color, depending in age.



Warehouse Beetles & Larvae

Biology

Eggs laid by the female become adults in about a month.

Damage

Warehouse beetles are one of the more voracious feeders and most important pests in museums. These pests infest not only fabrics but also a wide variety of stored products. They feed on seeds of all kinds, dead animals, candy, dog food, dead insects, milk products, starches, stored cereal products, dried grain, insect collections, hides and skins. If food is

scarce, some will cannibalize one another or feed on their own cast skins, and can survive for an extended time without any food.

RICE WEEVILS (Sitophilus oryza [L]) AND GRANARY WEEVILS (Sitophilus granarius [L])

Rice weevils and granary weevils are two similar-appearing snout beetles found and transported in whole-grain products throughout the United States.





Rice Weevil

Granary Weevil

Adult beetles have long snouts with jaws at the tip; females use their jaws to drill holes into whole grains, where they deposit eggs. Larvae eat the interior of the seed during growth, pupate, and emerge as adults to renew the cycle. Rice weevils fly, but granary weevils do not. Although these two weevils are more common in granaries and mills than in urban structures, they sometimes infest a wide variety of cereal grains and seeds, including popcorn, puffed wheat, corn and other stored seeds. The presence of adults requires that all stored products be checked and that infested ones be discarded.

CIGARETTE BEETLE (Lasioderma serricorne [F]) AND DRUGSTORE BEETLE (Stegobium paniceum [L])

THE CIGARETTE BEETLE is .25 cm (1/10 in) long, reddish-yellow to brownish-red beetle with a stout, oval shape and may be confused with the drugstore beetle. The head of the cigarette beetle is hidden by the thorax in dorsal view and the beetle has a hump-backed appearance when viewed from the side.



Cigarette Beetle

The .51 cm (1/5 in) long cigarette beetle larvae are dirty-white, hairy and have yellow-brown markings on the head capsule.

Biology

The cigarette beetle's life cycle usually takes about 90 days, depending on environmental conditions. Females lay up to 100 eggs. The larvae cannot develop below 18°C (64°F), nor survive in less than 35% humidity. Major swarming of adults occurs May and August. The larvae are photophobic and tunnel through materials to create a chamber from bits of food materials in which they pupate. Adults only live from two to six weeks but are strong flyers and are attracted to light.

Damage

Both the larvae and adults attack a wider range of products than other stored-food pests. They are primarily found in tobacco, spices, beans, books, drugs, wood (feeds on both hard and soft woods), paper, cellulose textiles, baskets, herbarium specimens, some upholstered furniture, grain-based rodent bait and cloth materials such as silk.

THE DRUGSTORE BEETLE is .25 cm (1/10 in) long, uniform light brown beetle that resembles the cigarette beetle. Drugstore beetles are slightly larger, more elongated, have striated wing covers, appear hump-backed, and have three segmented and clubbed antennae. Adults are covered with fine, silky hair. The larvae also resemble the larvae of the Cigarette Beetle and are white with a brown head capsule, but are much less hairy than the Cigarette Beetle larvae.



Biology

The life cycle of the drugstore beetle ranges up to seven months, depending upon environmental conditions. Adults lay eggs on a food source that hatch in two to three weeks, and the larval stage lasts up to five months. Up to four generations per year may be produced. Adults are often not seen in infested materials because they hold their legs and antennae close to their body when at rest.

<u>Damage</u>

The drugstore beetle will eat almost anything ranging from paper, fabrics, books, grain, flour, seeds, baskets, wooden objects, structural building supports, spices, leather, hair, wool, mummies, dry pharmaceuticals, medicinals, poisons, vegetable matter, etc., and will penetrate and damage sheet aluminum foil, tin and lead.

RED (Tribolium castaneum [Hbst.]) AND CONFUSED (Tribolium confusum [Duval]) FLOUR BEETLES

These insects are .30 cm (1/8 in) long, reddish-brown in color, and have short, stout antennae. Larvae are only slightly longer than adults, cream-colored, and with few hairs. They infest packaged and milled cereals such as flour, cornmeal, and cake mixes. Bulk flour may remain stored long enough to allow eggs or larvae, that were not killed during milling and packaging, to develop.



Red Flour Beetle

These very similar beetles can be distinguished by their antennae. The red flour beetle has the three end antennal segment abruptly widening. The confused flour beetle has gradually broadening antennal segments at the end.

Biology

The confused flour beetle, in cooler climates, is usually restricted to warmer sites. Adults cannot fly and may live up to three years during which time they produce about 500 eggs.

The red flour beetle adults are strong flyers and infestations may come from grain storage or food manufacturing nearby.

Damage

The confused flour beetle is principally a secondary pest of stored cereals, flour, spices, etc., but also infests museum specimens.



Confused Flour Beetles

The red flour beetle favors flour and processed grain, especially that damaged by weevils and grain borers.

The presence of these pests enhances mold development and imparts disagreeable tastes and odor to flour. They also feed on shelled nuts, dried fruits and milk chocolate. Management requires that the source of infestation be discarded or sanitized and the storage area thoroughly cleaned. This should be done in a quarantine receiving area.

DERMESTID BEETLES (Carpet Beetles)

There are a many different kinds of carpet beetles in the United States, and all have greatly varying life cycles and habits. Therefore, it is best to request pest identification by an insect specialist before considering management. In nature carpet beetles are scavengers that infest bird, mouse, rodent, tent caterpillar, old bee or wasp nests, and spider webs. In general, adult carpet beetles are broadly oval in shape, .15 - .3 cm (1/16 - 1/8 in) long, and calico, brown, or grayish in color. The round shape and mottled color distinguishes fabric beetles from such other stored-product pests as flour and grain beetles. Female carpet beetles lay up to 100 eggs, which hatch in about two weeks. Carpet beetle larvae are brownish or yellowish, about .64 - 1.27 cm (1/4 - 1/2 in) long, with slender bodies that taper towards a tail bearing tufts of hair on the upper surface. The larvae are covered with fine barbed hairs (an effective protection against insect predators). Larvae are generally found on products of animal origin. Adults are attracted to the light at windows. Below are examples of several pests of fabrics, furs and animal origin products.



Black Carpet Beetle Attagenus megatoma



Dermestid Larvae



Varied Carpet Beetle Anthrenus verbasci



Varied Carpet Beetle Larvae



Furniture Beetle Larvae



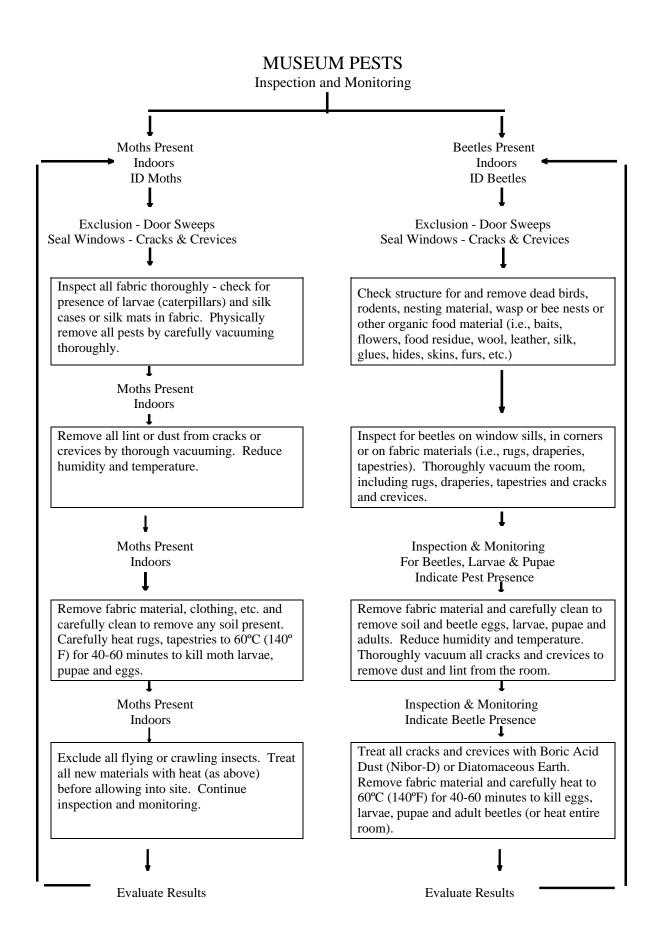
Spider Beetles Mezium americanum (laporte)



Hide Beetle Dermestes frischi



Larder Beetle Dermestes lardarius L.



PSOCIDS - BOOKLICE (Worldwide)

Booklice: (Liposcelis corrodons) but also many other species. Cosmopolitan distribution.

<u>Description</u>: Psocids or Booklice are small (.1 - .3 cm [1/25 - 1/8 in] long), opaque to white in color, soft-bodied insects with four wings, or only wing buds in adults.



Psocids

Biology: Outdoors, booklice live under tree bark and feed on fungi; they lay eggs during fall and spring. Indoors, booklice feed on mold and mildew and under proper conditions breeding and development can continue indefinitely. Booklice are most commonly found in dark cracks and crevices. Females of at least one species can reproduce parthenogenetically and produce from 120 to 450 eggs per season in clutches that average about 20 to 50 eggs each, depending on temperature conditions. The insects can over winter in the egg stage. After

eggs hatch through gradual metamorphosis, booklice attain maturity in around one to two months and can live up to three months. Moist conditions enhance growth and longevity and booklice

are most common in structures during spring and summer. Large populations can suddenly appear under high humidity or moisture conditions. Psocids may also be found in bird or mammal nests, moist grain or other starchy plant material.

<u>Damage</u>: Booklice damage paper products, bindings and eat paste, glue or anything supporting mildew. Psocids generally feed upon microscopic molds. They often infest damp, moldy books, feeding on both the mold and starch in glues. They also will infest dried plants in herbaria, insect collections, and furniture stuffed with flax, hemp,



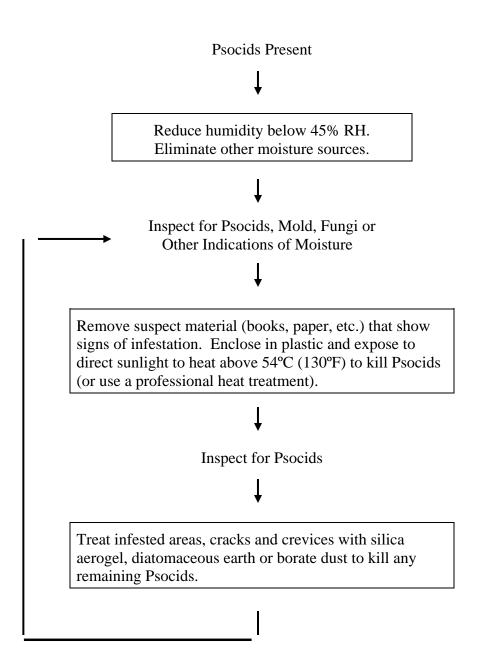
Winged Psocid

jute or Spanish moss. The presence of booklice is an indicator of moisture problems.

<u>Monitoring</u>: Sticky traps may not be attractive to Psocids except in large populations. Direct observation of susceptible materials may be necessary. The presence of mold, fungi or other indications of high humidity or moisture are clues to conditions favorable to psocids. If mold is present, look for psocids!

Management Action: Psocids are best managed by reducing the humidity below 45%. This may take some time, but eventually all psocids will desiccate and die. Removing other moisture sources will also help. For infested books or other materials, placing them in a clear plastic bag and exposing them to direct sunlight to heat the interior about 54°C (130°F) will kill localized infestations. Diatomaceous earth, silica aerogel or borate dusts will manage psocids.

PSOCIDS - BOOKLICE



SILVERFISH AND FIREBRATS (Worldwide)



Silverfish

Silverfish (*Lepisma saccharina L*), are wingless, flat and carrot-shaped insects, about 1.27 cm (1/2 in) long, and covered with a sheen of silvery scales. They have two long antennae and possess three long, slender filaments that project rearward from the abdomen. Silverfish prefer temperatures between 21 - 27°C (70 - 81 °F), and high humidity. Adults may live from two to eight years, and can survive as long as a year without food. Silverfish feed on starches like flour, glue, paste, and textile and paper sizing, but they can also digest cellulose.

Silverfish populations build up around materials upon which they feed, such as corrugated cardboard boxes in damp basements, and on insulation, glue, and stored books. Silverfish lay eggs in cracks over an extended period of time, which hatch in about 30 days. Immatures reach maturity in three to four months. Their feeding leaves irregular, yellow-stained holes in textiles and paper, damaged surfaces on corrugated cardboard, and irregular chewed areas on cloth-

bound books. Damaged materials often have dark fungus growing on them supported by humidity and insect fecal pellets. Large populations of silverfish spread into other humid areas within the building from basements and wall voids penetrated by pipe ducts and electrical conduits.

Firebrat

Firebrats (*Thermobia domestica [Packard]*) are similar insects but not silver-colored, rather mottled dark gray and dull yellow. Their size, shape, and appendages very much

resemble silverfish, but firebrats prefer decidedly higher temperatures and surroundings, to 32°C (90°F) or above. Firebrats are commonly found in furnace rooms, steam-pipe tunnels, hot bathrooms, and partition walls of water-heater rooms. The firebrat female lays one to three batches of average 50 eggs per batch depositing them in cracks. It takes two to four months from egg to adult under optimum conditions (32 - 38°C [90 – 100°F] with 76 – 85% relative humidity). Firebrats feed on carbohydrates and proteins such as bond paper, linen, cotton, silk, dried beef, etc.

HAZARDS OF INFESTATION

Silverfish and firebrats are destructive to books, paper, fabrics, and may contaminate foods. These insects are often found in libraries, book shelves and areas where old books and papers are stored.

INSPECTION AND MONITORING

In a quarantine area, thoroughly inspect incoming goods, furniture, books and other materials for the presence of silverfish or firebrats. Remove or treat any items that are infested.

Conduct a thorough inspection for the presence of pests, moisture, food sources, clutter, cracks, crevices and other openings. Inspect water heater closets, utility rooms and areas of high humidity and temperature. Bookcases and books are especially attractive to these pests.

MANAGEMENT

Exclusion

For pests the size of silverfish or firebrats to be excluded, use caulk, Stuf-Fit, oakum, weather stripping, door sweeps, screens and other repair approaches. Once done, excluding silverfish and firebrats is usually passive and permanent.

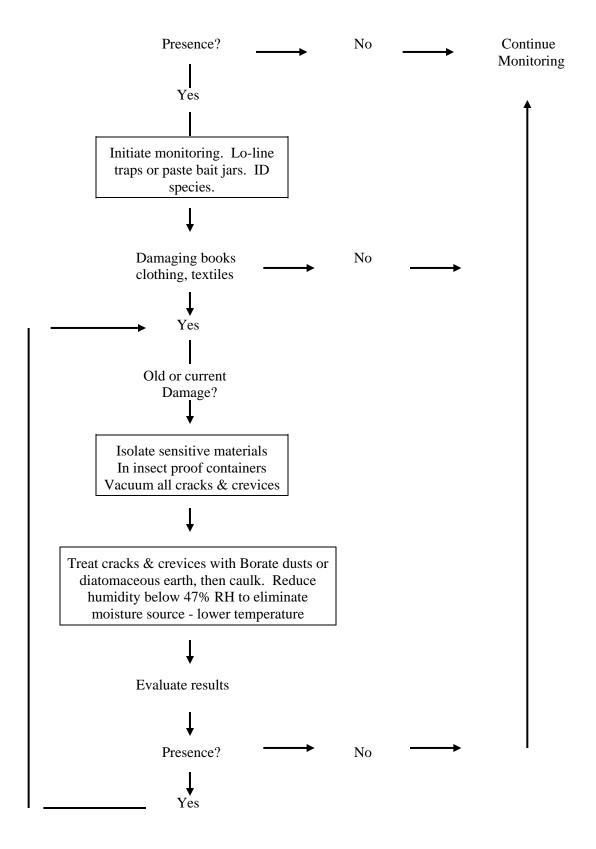
Sanitation

It doesn't take much organic material to feed silverfish or firebrats. Water in any form, condensation, leaks or moisture in potted plants, etc., should be eliminated. Silverfish and firebrats like to be in an area where they feel safe – in between things. Clutter that builds up in corners, on cabinets, shelves or on the floor becomes harborage for firebrats, silverfish that can attack and ruin irreplaceable historic artifacts. Sanitation is active and must be conducted on a daily basis.

Habitat modification

Eliminate food, water and shelter. Other means are raising or lowering temperatures or reducing humidity to levels intolerable by pests, and increasing lighting. Habitat modification is relatively passive and semi-permanent.

SILVERFISH AND FIREBRATS



ASIAN LADY BEETLE Harmonia axyridis (Pallas)

The Asian lady beetle, *Harmonia axyridis* (Pallas) was introduced into the United States between 1910 and 1970 unsuccessfully (no survival). After years without a sighting, the beetle was seen in Louisiana in 1988, apparently from an accidental introduction in a freighter from Asia to New Orleans. Since that time, the Asian lady beetle has spread throughout the northeast from Florida to Quebec, and west to Missouri and Texas. It has also been reported in Colorado, Oregon, Washington, and British Columbia, Canada.

The Asian lady beetle is a voracious feeder on aphids, scale and other soft-bodied insect pests. Both the adult and larval forms of the beetle are predators on soft-bodied prey. In its native habitat (most of Asia), it tends to overwinter in larger congregations in white cliffs, cracks, crevices and other voids. Here in the United States, the Asian lady beetle tends to aggregate in large numbers in homes, structures and other human-constructed or occupied sites. When they overwinter in a historic structure which contains valuable artifacts, their presence may



Asian Lady Beetles

pose a hazard. Large numbers of beetles in structures over a harsh winter causes a number of the beetles to die. It could be a few or many. The dead beetles can become a food source for dermestid beetle larvae. Dermestid beetle larvae or adults in a historic site may become a major threat for organic material in the collection, including furs, woolens, sinew, cotton, silk or other material on display.



Dead Harmonia & Dermestid Larvae

The first line of defense against the beetle is to fill all cracks, crevices, holes or other entry points into the structure. A hole as small as .53 cm (7/32 in) wide can allow beetle access to the inside of the structure.

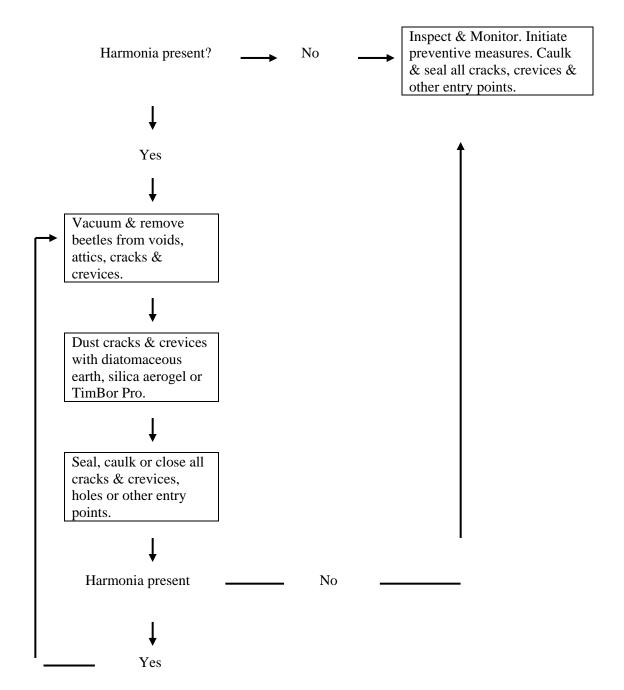
The second line of defense is sanitation. The beetles like to use clutter in which to overwinter. Elimination of clutter will reduce the areas where the overwintering beetles congregate.

The third means of managing the beetles once they are in the structure is to use a vacuum to remove

them in large numbers. Black light (ultraviolet) traps with a sticky glue board to collect the beetles attracted to the light are also useful. The traps should be checked periodically and the glue boards replaced when full.

Vacuum the joists, beams and other accessible voids in the attics each spring and late fall.

ASIAN LADY BEETLE CHART



HOUSE CRICKET (Acheta domesticus [Linnaeus]) (Worldwide)

House cricket adults are 1.91 - 2.54 cm (3/4 - 1 in) long and have a light-colored head marked with three dark cross bands, yellowish-brown to straw-colored body, long and thin antennae, and heavy mandibles. House crickets fly but also have large rear jumping legs like a grasshopper. Crickets are nocturnal insects that enter structures in spring or before winter. They are attracted to shelter, light, moisture, and warmth. House crickets are mainly attracted to warm areas



Nymph & Adult House Crickets

around stoves, fireplaces, and furnaces, but they can also be found throughout the structure.

Incessant nocturnal chirping by the male makes this a nuisance pest. Outside, house crickets live in compost piles, debris, and garbage dumps. Usually there is one generation per year. Eggs laid in sandy soil during fall hatch in late spring. Nymphs often enter structures under doors or through cracks and voids and complete their life cycle indoors, where

they develop all year and lay eggs in cracks. Nymphs mature in mid- to late-summer.

Outside, house crickets feed on plants and other insects. Inside, their diet is more diverse: they feed in early evening on bread crumbs, fruits, vegetables, liquids, paper (such as soiled newsprint), clothing, rubber, silk, wool, linen, rayon, fur, feathers, meat and meat products, dead insects, and leather. House crickets contaminate food by walking over it.

INSPECTION AND MONITORING

<u>Outside</u>: Inspect for the presence of house crickets near the structure. Also check for moisture near the building, and for organic material (mulch, leaves, etc.) that provides harborage and food. Look for cracks, crevices and other openings (drains, pipes, vents) into the structure that provide entry for house crickets.

<u>Inside</u>: Conduct an inspection for the presence of moisture, food sources, clutter, cracks, crevices and other openings. Place and check WEEKLY sticky trap monitoring devices at floor/wall junctions and other likely or critical areas where house crickets may occur.

FIELD CRICKETS (Gryllus spp.) (North America)



Field crickets are common pests attracted indoors by light; however, once inside, they die before early winter because they cannot adapt to indoor conditions. Adults are 1.27 - 2.54 cm (1/2 to 1 in) long and look very similar to house crickets, except that field crickets are usually black to dark brown in color, and have brown wings, a shiny head, and antennae much longer than the body. Males have two spear-like appendages at the tip of the abdomen. Females have three similar appendages.

Field Cricket

The field cricket also flies and jumps. In northern parts of the United States, eggs deposited in the ground are the overwintering stage for most field crickets. The small remainder pass the winter as half-grown nymphs under leaves, trash, and debris. There is only one generation per year. Females lay 150 to 400 eggs about .64 - 2.54 cm (1/4 - 1 in) deep in the soil in late August to September. Eggs hatch in May to June and nymphs develop in nine to 15 weeks. Adults are only found outside from late July until the first hard freeze. Field crickets migrate into structures during fall, when populations are large, or as vegetation dries up.

Indoors, field crickets are attracted to such warm, dark areas as water-heater closets and large appliances. They are usually found in basements and ground-floor levels where they feed on human food, debris, and clothing. Field crickets do not live long indoors. However, they can cause damage to cotton, wool, linen, silk, synthetics, and leather and fur items.

INSPECTION AND MONITORING

<u>Outside</u>: Inspect for the presence of field crickets near the structure. Also check for moisture near the building and for organic material (mulch, leaves, etc.) that provides harborage and food.

<u>Inside</u>: Conduct a thorough inspection for the presence of crickets, moisture, food sources, clutter, cracks, crevices and other openings. Place and check WEEKLY sticky trap monitoring devices at floor/wall junctions and other likely or critical areas where field crickets may occur. Inspect water heater closets, utility rooms and areas of high humidity and temperature.

CAVE OR CAMEL CRICKET (Ceuthophilus spp.) (Worldwide)

Cave or camel cricket populations build up indoors during fall, when large numbers of these insects move under doors and through cracks, seeking dark, cool, damp areas in crawlspaces, basements, utility rooms, garages, and outdoor sheds. They are rarely found in occupied spaces. Their natural habitat is outside, where camel crickets live under stones and logs or in animal



Cave or Camel Cricket

burrows. Camel crickets have a rounded, hump-backed appearance with a head bent downwards. They are light brown in color with darker brown bands and markings. Camel crickets are easily identified by their long antennae and long and large jumping hind legs. They are wingless, don't chirp, and are not attracted to light. Most importantly, camel crickets serve as a warning or indicator of excessive moisture problems. Camel crickets can feed on cotton, linen or other cloth material.

INSPECTION AND MONITORING

<u>Outside</u>: Inspect for the presence of cave crickets near the structure. Also check for moisture near the building and for organic material (mulch, leaves, etc.) that provides harborage and food. Look for cracks, crevices and other openings (drains, pipes, vents) into the structure that provide entry for pests.

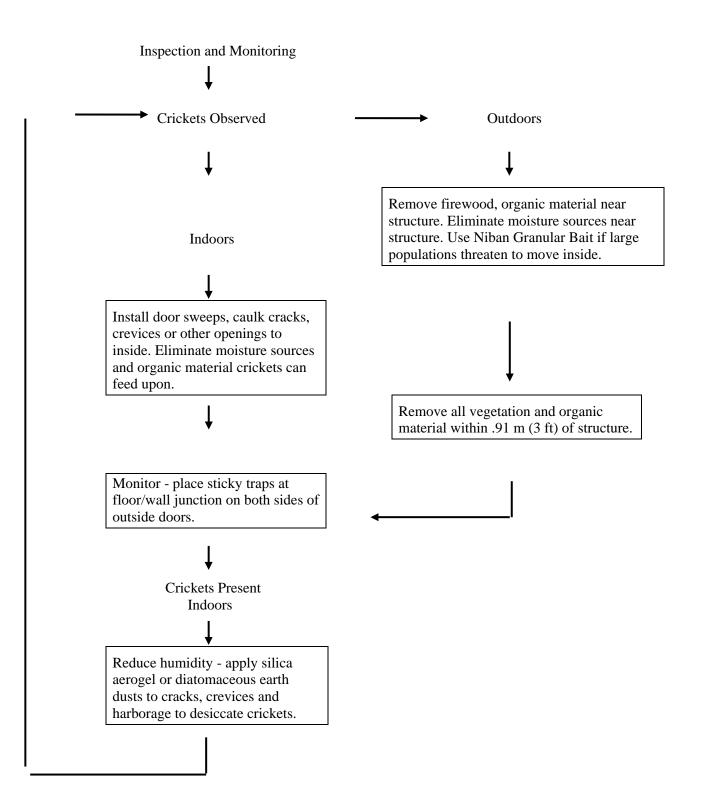
<u>Inside</u>: Conduct a thorough inspection for the presence of crickets, moisture, food sources, clutter, cracks, crevices and other openings. Place and check WEEKLY sticky trap monitoring devices at floor/wall junctions and other likely or critical areas where cave crickets may occur. Inspect water heater closets, utility rooms and areas of high humidity.

MANAGEMENT

<u>Outside</u>: Remove all organic material (mulch, leaves, etc.) from within .91 m (3 ft) of the structure (replace with a 1.91 - 2.54 cm [3/4 - 1 in] mulch or gravel) and eliminate moisture and standing water in this area. Install effective door sweeps on all outside doors and eliminate other entry points into the structure.

<u>Inside</u>: Reduce humidity levels and eliminate leaks and other water sources. Keep corridors, offices, exhibits and storage spaces clean (no organic material available to the pest). Eliminate clutter, caulk cracks, crevices and close hiding places. Dust cricket harborage with diatomaceous earth (DE) or borate insecticide.

CRICKETS



STRUCTURAL PESTS

TERMITES AND THEIR MANAGEMENT

INTRODUCTION

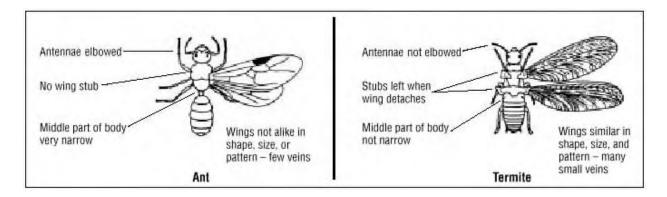
Termites are the most destructive wood-destroying insects in the U.S., costing hundreds of millions of dollars each year in prevention efforts, direct damage to structures and trees, and corrective costs. In older structures, about one of every ten is infested to some degree, while in newer structures; perhaps one in 20 is infested.

Termites are social insects belonging to the order *Isoptera* (meaning equal wings) and, like the cockroaches to which they are closely related, have been around for hundreds of millions of years. As inhabitants of forests, they serve a valuable function in the ecosystem by consuming dead and decaying wood. When people began to build wood structures, these structures became additional food sources and habitat for termites. Termites sometimes endanger the structural integrity of buildings.

Termites are classified according to their primary habitats subterranean, dampwood, and drywood termites. Only eastern subterranean termites are likely to be found at FIIS. By far, the subterranean termites are the most widely distributed. They occur throughout most of the 48 contiguous states, Hawaii, lower Alaska along the pacific coast, and the Caribbean territories. Because of the ever-present threat to housing and other wooden structures, vigilance is necessary to prevent, mitigate, and eliminate termites.

CHARACTERISTICS AND RECOGNITION

Usually, the first experience with termites is when they swarm around structures by the thousands during spring. For the termites, this is a dispersal flight as they begin spreading to new areas. People usually report "flying ants" and immediately call their exterminator. The pest management supervisor identifies these flying insects as termites, and points out the differences between true flying ants, which have two pair of unequal wings, elbowed antennae, and a narrow waist, and termites, which have two pair of nearly equal wings, straight antennae, and a thickwaist.



Typically, the subterranean termites swarm in the early spring on a warm day after a rain. Warmth, sunlight and moisture are the three elements necessary for the survival of this species, and the reproductive termites sense that these conditions will enhance their chance of survival. Close inspection of the building may show piles of detached termite wings, the small (less than .63 cm [1/4 in]) white worker termites in wood below ground, and their galleries in wood structures.

BIOLOGY OF SUBTERRANEAN TERMITES

Subterranean termites, the most widespread and destructive termites in the U.S., have their nests underground and within easy access of wood which is their only food. They are social insects with a complex division of functions including a queen, king, soldiers, supplementary reproductives and workers.









King & Queen

Reproductive

Soldier

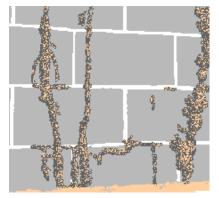
The life of the colony depends on the queen, which is a greatly enlarged, light brown, winged termite about 1.27 cm (1/2 in) long. The queen can lay millions of eggs over her lifetime of over 25 years. Her egg-laying activities are augmented by supplementary wingless reproductives as the queen ages or the colony outgrows its original nest. The king is the same size and color as the queen and also has two pair of wings. It exists only to mate with the queen, and lives, as does the queen, entirely within the subterranean nest once it is established.

The supplementary reproductives are light in color, about .63 cm (1/4 in) long, and have two pair of wing pads. They also stay entirely within the underground nest. The soldiers are white, except for an enlarged brown head capsule, and are about .79 cm (5/16 in) long. They defend entrances to the nest against enemies, particularly ants which are the primary enemies of termites.

The workers, which are actually nymphs, are entirely white, about .46 cm (3/16 in) long, and do all of the foraging and feeding activity of the colony. They may live up to five years, and are the ones that venture above-ground into structures, construct the galleries, bring wood back to the nest, and build the mud tubes that connect the nest to the galleries and the structure. They also feed the young nymphs and other castes which cannot feed themselves.

Since the termites' ability to digest cellulose is totally dependent upon the protozoans living within their midgut, it is imperative that workers exchange anal fluid containing these organisms

so that young termites can digest their food. This is accomplished by grooming among workers, a process that is important in selecting a pest management strategy.



Subterranean Termite Mud Tubes

The conditions that termite colonies need to flourish are rather basic, but critical. They include relatively high moisture content in their living and feeding areas, adequate shelter and temperature, and a plentiful food source. The colony will not flourish if any of these is lacking. The high moisture content need is met by the soil in most parts of the country. Even coastal beaches, deep in the sand, provide ample moisture for termite colonies. The soil also provides termites the necessary protection from desiccation, since their cuticle is rather permeable and they can easily die from

exposure in air. It has been theorized that the connecting mud tubes from above ground food sources to nests (built from mud, digested wood, and termite secretions and

excretions) protect termites against dehydration along the journey from the nest to the food source and back.

These tubes may also provide protection against enemies, primarily ants. The minimum tolerable temperature for termites is -30°C (-22°F). This does not mean that termites can flourish at this temperature, but rather that they can withdraw deep enough into the ground to survive that outside air temperature for a short period, usually a matter of weeks. If they have to stay too deep for too long, however, they are deprived of their primary food source, decaying wood.

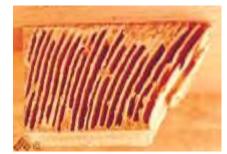
Human habitats are ideal for termites. They provide the cellulose needed for food and the temperatures beside and underneath the building allow year-round activity by the colony. It does not take much wood to attract a mated pair of termites to set up housekeeping; a piece of a discarded 5.08×10.16 cm $(2 \times 4$ in) in a foundation void will do it. Of course, once that food source is exhausted, termites will move on through cracks in the foundation to find another food source, usually in the interior of the structure.

Damage

The damage done to wooden structures may take years to reach the point when any evidence is visible. Often the area of damage is inaccessible, such as behind basement walls, in crawl

spaces, or where floor joists meet the wall studs. Termites prefer to eat the softer portions (the spring sapwood) of beams, joists, studs, door jambs, window sills, or wood paneling, leaving behind enough of the harder summer sapwood to keep the structure intact.

Termites will also eat through plastic sheathing, foam insulation, and any other soft obstacles on their path to their foraging sites. If there is moisture in the wood, the



Termite Damage

destructive process is accelerated by fungi carried on termites' bodies. Their activities also tend to increase the moisture content in the wood they forage in. Termites deposit their frass (droppings) inside the galleries or use it together with earth and decayed wood to construct mud tubes. The mixture of feces, frass, and decaying wood gives the galleries a dirty appearance.

Over a period of years, the wood may become so thin that literally only paint is holding it together and just touching it can cause the wood to give way. Ultimately, the building may become structurally unsound, and major supporting members may require replacement.

INSPECTION AND MONITORING

Foundations

In order to inspect and monitor for termites, it is important to understand structures and the structural defects that lead to termite infestation.

For subterranean termites, the most common routes of infestation are the basement or ground floors of structures including:

- Poured-concrete slab foundations,
- Raised concrete foundations and footings,
- Vertical void concrete masonry block foundations,
- Brick foundations, and
- Stone and rubble foundations.

Other than solid poured concrete basements, the floor slab is usually supported by footings underneath and at the perimeter, and walls rest on top of the slab.



Subterranean Termite Entry Points

The slab usually has underlying gravel. Caps at the tops of foundations can be solid block caps, poured-concrete caps, top course of hollow blocks filled with concrete, or brick caps.

Sometimes supporting posts or stairs extend through the concrete slab to the soil below. Wherever there is a joint between the wall and floor, or the wall and cap, there is opportunity for cracks to develop which become entry points for termites. Similarly, cracks in the wall, mortar between blocks, bricks, or masonry provide entry points for termites. Faults in the blocks may also provide access for termites to the joists.

Poured concrete wall and pier construction, brick, hollow block, masonry walls, or wooden piers, are all used in buildings constructed

on raised foundations. Piers constructed of poured concrete, concrete blocks, bricks or treated wood provide support for the girders and floor joists. Termites gain access through cracks or voids that occur. Access through piers or directly from the crawl space itself are easy portals of

termite entry, since the distance is short and mud tubes may escape notice. Subterranean termites commonly gain access to structures by building shelter tubes from the ground to the wood over concrete piers, foundation walls, and from underneath exterior soil-filled porches and patio slabs.

Slab-on-grade construction has become very common in the last 30 years. The monolithic slab, consisting of a solid, unitized pad and footing, offers protection against termite infestation. The supported slab is another type, which is tied at its ends to the foundation wall. The floating slab is the third type, which is structurally independent from the foundation wall. It "floats" over a gravel layer.

All three types of slabs provide access for termites once cracks develop in the slab or foundation wall. This scenario is most likely to occur at the expansion joint of the floating slab. Once in the building, termites have ready access to the wooden studs, joists, floor sheathing, and finished interior wood.

Site History

The pest manager should be familiar with the history of the site. Sites that were once heavily wooded areas, particularly with softwood trees, often have dense populations of termites. Sources of moisture in structures may also be areas where termites are attracted, and need careful scrutiny. Utility pipes and electrical conduits that run under a structure or up from the ground are natural paths for termites to invade. These termite highways should be checked carefully for mud tubes.

Tools

The tools of inspection are a flashlight, awl or ice pick, small hammer, moisture meter, hacksaw blade, measuring tape, and electronic stethoscope or other sound-listening device. In addition, an inspector needs coveralls, knee pads and bump hat to safely get into tight areas under the structure and graph paper to diagram termite entry points and damage. A stepladder is needed to gain access to the attic and to high areas of the exterior.

THE INSPECTION

Before starting the inspection, always interview the occupants. Often they have some knowledge of previous termite problems, where moisture occurs, and possible hidden joints or voids. Next, size up the exterior of the structure and draw a diagram on graph paper, noting dimensions, grading, drainage, garages, decks, any structural wood in contact with soil, and location of wood piles. The graph also should account for hidden joints, voids in porches, and moisture-laden areas.

Note any exterior wood that shows excessive moisture or decay. Inspect the interior areas adjacent to this decay for further evidence of damage or infestation. Also, observe any possible roof leaks either under the shingles, around chimneys, or toward the structure after exiting downspouts. Blistered paint, insect or woodpecker attack areas, and evidence of insect exit

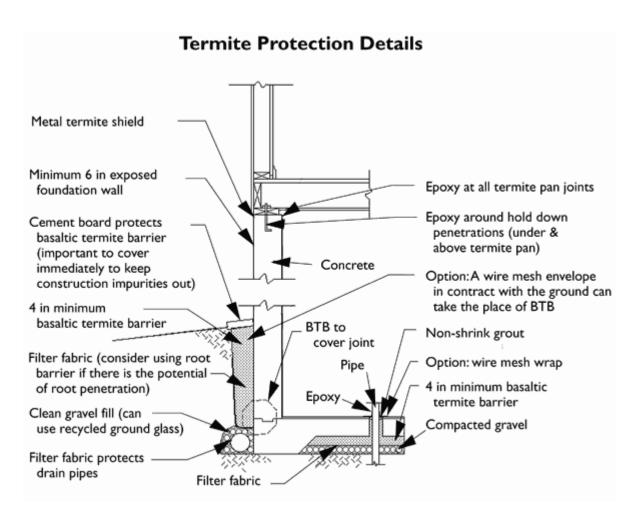
holes, feces, or sawdust are additional points of concern. Outside, in areas where there are planters or earth-filled porches, use a hacksaw blade to insert under window and door sills. The blade should not penetrate beyond the sills or headers. Note any areas where the outside grade is higher than the top of the foundation or slab. This "faulty grade" condition will allow direct access for termites to the wall studs and will contribute to excessive moisture and decay.

In the interior, examine every room systematically. Look for possible signs of decay, damage, and moisture in all wooden structures. For example, if there is a drip or leak under the sink, fill up the sink and examine underneath after it empties to see if water appears at the bottom of the cabinet. If water is leaking from any area, "sound" (tap and listen for a hollow sound) the nearby wood with a hammer, then look for possible mud tubes in adjacent areas. In walking through a structure, notice whether or not floors seem to sag or buckle in places. Sagging members may indicate termite damage. Similarly, water stains, buckling paint, or bulging plaster are indicative of moisture-laden areas which bear further scrutiny. Stained walls may occur where subterranean termites have been depositing mud on inside surfaces of walls. Sound baseboards as well since these are primary areas of attack. Examine cracks occurring around door or window frames since these may be portals of entry.

Inspect bathrooms carefully. Pay particular attention to shower pans and shower or bathtub enclosures as these areas often leak, causing decay and contributing to dry rot and termite infestation. Toilet leaks are common at the point of contact with the floor. Decay or rot is also common at the floor area around the toilet.

In the basement, carefully examine areas around the base of stairs and support posts which may extend through the floor slab. Also, examine the floor joists at the juncture of basement wall for signs of sawdust, feces and spider webs. Probing suspect timbers with an ice pick or sounding, using a small ball peen hammer, may yield a positive finding. Inspect plumbing accesses throughout the structure, as these often will reveal frass, mud tubes, or feces if termites are present. Carefully inspect the underside of stall showers and toilets for leakage, dry rot or termite infestation. Stall showers should be water tested for 15 minutes and inspected for leakage from the basement or substructure if these areas are accessible.

In slab-on-grade construction, look carefully at the expansion joints when these joints are visible for inspection. Occasionally subterranean termite infestations will extend into moist attic areas. Inspect bracing and rafters carefully for evidence of damage or mud tubes. Note any inaccessible areas in the report. Pay particular attention to evidence of leaking water, especially around chimneys, vent pipes, and roof sheathing.



Carefully inspect every part of the crawlspace by using a flashlight, since it is a likely area for hidden termite mud tubes because of the proximity of ground and the first floor wood substructure. Also check the storage sheds and temporary buildings which usually give termites easy access to the structure, if attached or nearby. Pay close attention to areas in which infestation, damage, excessive moisture or faulty grade conditions were noticed from interior or exterior inspection. Signs of infestation or damage may also exist in the substructure. Inspect the areas adjacent to earth-filled porches for evidence of subterranean termites entering from the earth fill. Finally, review carefully any unseen areas and voids, and record such data on the inspection diagram.

Regardless of the type of termite infestation, it is imperative to describe as thoroughly as possible the origin of infestation as well as its extent. In addition to the diagram, a descriptive report must be prepared for future reference, whether or not there is an actual infestation. A list of areas to inspect when performing a termite inspection can be found at the end of this chapter.

PREVENTIVE MEASURES

The implementation of preventive measures discussed in this section can minimize costly repairs of termite damage.

Subterranean Termites

Subterranean termites cannot thrive without ample moisture in the wood of structures, in the adjoining soil, or both. Therefore, repairing defects and correcting patterns that allow water or excess moisture into any part of the structure, will help minimize termite damage. For example, if the ground slopes toward a structure, it should be regraded to redirect the runoff. It is also necessary to ensure that the water from roof, downspouts, porches, driveways, patios, and slabs runs away from the structure, and that leaky drains, baths, toilets, and plumbing are repaired inside the building. If crawl spaces have no ventilation, installation of vents will prevent moisture accumulation. Gutters should be clear of debris so that water does not pour over the top during rainstorms. Roof flashing must not allow water to flow under the membranes and shingles. Flashing around chimneys and vents should be tight and sealed so that water cannot run down into the structure. Tree branches which are moist and close to the structure should be cut back.

It is also necessary to remove wood debris from under the building or near the foundation, firewood that is closer than three feet to the building, and wooden planters next to the building. Modify untreated wooden structural members so that they are more than 45.72 cm (18 in) away from the soil. This may involve regrading if siding or joists are too close to the soil, or installing metal termite shields or a concrete barrier beneath the wood. If decay is evident but slight, treat unpainted wood with a suitable wood preservative such as BoraCare or TimBor. Treat exposed untreated wood. Replace supporting posts, stairs, and fences made of untreated wood with pressure-treated wood. Caulk areas where moisture can enter around windows, door frames, or sills. Remove bark or wood chip mulches next to the structure and replace with decorative rock mulch.

Foam insulation has become a concern in recent years since termites, while not digesting foam, easily tunnel through it to reach wood. Where foam insulation is in close contact with the ground, it might mask termite tunnels and hide structural damage. Therefore, it is essential to ensure that it does not extend closer than 45.72 cm (18 in) from the soil. Even with this precaution, most termite-control companies will not guarantee against termite infestation if a building has foam insulation, because of the high risk of non-detection.

LOW RISK MANAGEMENT METHODS

Termi-Barrier: An innovative, non-toxic treatment, first suggested by Dr. Walter Ebeling in 1957, has been in use by Live Oak Structural, Inc. since 1989 in the San Francisco Bay area to prevent subterranean termites from entering structures. The "Termi-Barrier" is a layer of untreated sand that the termites cannot penetrate because the small particles are too big for the termite to grasp and move with its mandibles, yet the largest particles are not big enough to allow the termites to crawl between. The sand particles, ranging in size from 2.5 to 1.6 mm (.1 to .06 in), form a barrier that prevents termite penetration; however, particles larger or smaller than the narrow size range may allow termites to tunnel through. Sand barriers can be installed before concrete slabs are poured over them, or in crawl spaces around the foundation perimeter and under pier foundations.

The sand is placed 6.62 to 15.24 cm (3 to 6 in) deep next to foundation walls and tapered down to 2.54 cm (1 in) deep over a 25.4 cm (20 in) or more lateral distance from the wall. Occasionally the entire crawl space must be covered if termite activity is intense. Barriers outside the foundation must be capped with concrete or asphalt to prevent movement away from the wall by rain or other means. Periodic inspection of the integrity of the barrier is an integral part of this approach.

Termite Shields: Sheet-metal strips called termite shields have been installed historically during construction, ostensibly to prevent hidden termite entry through masonry walls. In actuality, termite shields are seldom properly installed, and once installed are rarely maintained. They are intended to force termites to build mud tubes over the metal so that they may be observed and treated. However, they are easily damaged and may hide termite activity if frequent observations are not made on the inside, as well as the outside, of the masonry wall. In this situation, termite entry is unimpeded.

Steel Mesh: Efforts are underway to evaluate a stainless steel mesh barrier, developed by Termi-Mesh, Ltd., and to make it commercially available in the U.S.

Diatomaceous Earth: Diatomaceous earth (DE) can be used as a termite barrier by applying it in strategic places. Natural DE is sold under the brand name Perma-Guard, which is available with or without pyrethrins.

THE FUTURE

Termites have been an economic burden to owners of homes and other structures that contain wood, paper or cellulose products for many years. A great deal of research has been, and is being conducted, to develop better and safer means to manage this costly structural pest.

The Sentricon System is now available by DowElanco to selected companies in the commercial pest control industry. Since 1988, Dr. Nan-Yao Su has worked on developing the method, which utilizes a monitoring system for subterranean termites and the biology and behavior of the termite to achieve management. According to Dr. Su, if no termites, keep monitoring. If termites show up in the monitoring device, then a bait tube is provided for the termites in a recruiting chamber. The bait material contains a chitin inhibitor (the juvenile growth hormones hexaflumuron or noviflumeron), which is passed throughout the colony by the termites' normal recruiting and feeding behavior, and eventually leads to the demise of the colony.

Beneficial nematodes have been marketed for subterranean termite control with mixed results. When research with nematodes yields consistently effective results for most sites and soil conditions, it will be considered a "low risk" method.

CHEMICAL PREVENTIVE BARRIERS

When deemed necessary, pesticide applications shall be performed by licensed applicators only. Applications shall be made according to the National Park Service Integrated Pest Management

policy and procedures guidelines, according to pesticide label directions, and following applicable laws and regulations.

Since few buildings are termite-proof, a preventive chemical-barrier treatment around buildings located in high risk infestation areas is a traditional precaution. Preconstruction treatment of structural wood can be accomplished with a dip-diffusion method, with a 10% disodium octaborate tetrahydrate solution. Such "TimBorized" lumber is available in many areas commercially. Additionally, sodium borate solutions can be applied to exposed structural wood during construction ("dry in" stage) or after construction is completed, which is also suitable for all wood that is not in contact with the ground and not exposed to rain. Applications can be made to wood in attics, walls, around windows, floors and sub floors, joists, and sill plates.

Sodium borate solutions penetrate into the wood, treating more than just the surface, and protect and preserve the wood permanently. Sodium borate functions as a slow-acting stomach poison in insects and decay fungi. Termites accumulate the active ingredients while they feed. These slow-acting poisons allow the termites to move throughout the colony to spread the insecticide by the feeding of nymphs, soldiers, and reproductives. Sodium borate solutions can be brushed or sprayed onto bare wood or drilled and pressure treated into known infestations.

A soil pre-treatment performed during construction usually provides an effective barrier for a specified time. The principle is to provide a pesticide barrier in the soil that will be in contact with the foundation and slab. Apply termiticide according to the label at the recommended rate. Before pouring concrete pads, a moisture barrier of polyethylene sheeting should be in place.

Soil treatment termiticides shall be applied in strict accordance with the recommended rates of the manufacturer which are shown on the container label.

Post-Construction Treatments for Subterranean Termites

If a structure has had termites in the past, or if there are conditions conducive to termites (evidence of infested wood around the foundation along with cracks in the foundation or porch voids), it is reasonable to assume that a chemical barrier is necessary to protect against future infestation. When an infestation occurs, the *entire* barrier requires re-establishment. Treating just the area of infestation often fails to prevent termite entry, and results in costly callbacks.

Unpainted or unsealed termite-infested wood can be remedied by painting (brushing) or spraying sodium borate solution on it. At the same time, eliminate moisture problems that may have led to and sustained the moisture needs of the colony. Wood with known infestations or galleries should be drilled and pressure-injected wherever possible.

Slab construction requires that pesticide not only provide a barrier around the outside, but also underneath the slab so that any possible cracks are protected.

If the infested areas are mainly structural, extensive, and inaccessible, fumigation may be selected. This is an expensive and highly technical procedure that should be undertaken only by

licensed fumigators. It, however, offers no protection against future infestations. The basic procedure is to wrap the entire building in gas-tight tarps made of nylon, rubber, neoprene, or plastic. Seams between sheets of the tarps are rolled together and joined with metal clamps or heat-sealed. The bottoms of the tarps are anchored to the ground with "sand snakes" (sand in bags). It is essential that the entire structure is airtight for fumigation, so careful attention to each detail is necessary. The building is fumigated with sulfuryl fluoride, or other registered fumigant. Fumigation exposure with sulfuryl fluoride is usually a 24-hour process. Additional time will be required for the aeration process.

In some states, the aeration period for Vikane (sulfuryl fluoride) gas is 24 hours. After the aeration period, the structure is reopened and the fumigator measures gas residues with a fumiscope. When the structure contains less than 5 ppm of Vikane, the fumigator can certify the structure for reoccupancy. Warning signs must be posted and maintained from the time the fumigant is introduced until the fumigator clears the building, prohibiting entrance into the building treated. During the fumigation and aeration process, secondary locks remain on the structure to guard against access until the building is safe to occupy.

Infested, stand-alone items such as furniture, construction timbers, or crates can be treated in a fumigation chamber or with heat in similar fashion as buildings.

AREAS TO INSPECT WHEN PERFORMING A TERMITE INSPECTION

Substructure

Foundations

Porches

Sub floor

Plumbing

Pier posts, pier pads

Heating ducts (high humidity)

Mudsill, floor joists and header joists

Ventilation

Shower drains and sub floor adjacent to the shower

Toilet drains and sub floor adjacent to the toilet

Inaccessible areas

Exterior

Foundations

Porches

Patios

Eaves, fascia boards and rafter tails

Exterior grade level

Drainage

Ventilation

Exterior siding

Exterior stucco

Columns and abutments

Attached fences, sheds, wood decks

Visually inspect the roof

Window sills

Porte cochere

Carports

Interior

Baseboards

Window ledges, sills and frames

Floors

Paneling, plaster board and other wall covering

Ceilings

Cabinets

Plumbing fixtures

Shower and bath tub enclosures

Toilet areas

Fireplace

Door jambs

Hollow doors

Door sills, thresholds

Inaccessible areas

Attic

All framing (joists, rafters and sheathing)

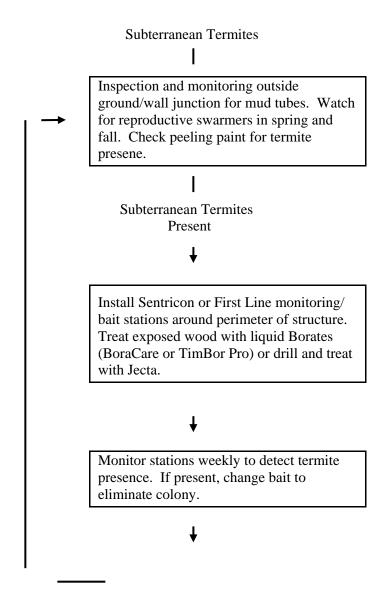
Ventilation

Heating and air conditioning system

Roof

Inaccessible areas

TERMITES



Evaluate Results

POWDERPOST BEETLES







Powderpost Beetle

Powderpost Beetle Damage

Powderpost Beetle Larvae

The first group is known as lyctid powderpost beetles. Lyctids are small, reddish-brown to black beetles about .3 - .64 cm (1/8 - 1/4 in) long, whose life cycle requires about a year or less and takes place entirely within wood, except for mating. They only attack the sapwood of hardwoods having large pores, such as oak, hickory, ash, walnut, pecan and many tropical hardwoods. They attack both new and seasoned wood, so they may occur either in structural members or in paneling, furniture and flooring.

Their damage appears when larvae construct numerous galleries, about .15 cm (1/16 in) in diameter, throughout the wood. Exit holes of .08 - .15 cm (1/32 - 1/16 in) in diameter on the wood surface (made as newly-emerged adult beetles escape from the wood), coupled with fine sawdust-like frass, may be the only evidence that lyctid beetles are at work. The frass may collect below the infested wood on spider webs, or it may fall out when slightly tapping the wood. The interior of wood may be so riddled with galleries that the remaining structure is only a veneer of surface wood. Replacement or removal of panels may be the best method if the infestation is not structural. However, if structural members are involved, the treatment depends on the extent of the infestation. If only exposed timbers are involved, a Borate insecticide may be the best treatment. However, if the extent of the infestation is uncertain, one should carefully examine and probe-delineate the infestation for treatment. Heat may then be the treatment of choice.

Anobiid beetles, also known as death-watch or furniture beetles, belong to the powderpost beetle



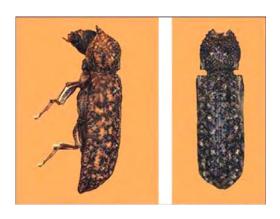
Death-watch Beetle & Damage

group. The adult beetles are also .3 - .64 cm (1/8 - 1/4 in) in length and reddish-brown to black in color. However, the adult beetles are rarely seen, and it is the fine frass, pellets and exit holes (.15 - .3 cm [1/16 - 1/8 in] in diameter) which indicate their presence. Their damage includes boring in the sapwood of both hardwoods and softwoods, and reinfestation of seasoned wood if conditions are favorable. Attacks often begin in attics or in poorly ventilated crawl spaces and then spread to other parts of the structures.

If the frass is yellowed or partially caked on the surface where it lies, the infestation is probably old or already managed. It may take ten years or more for infestations to become significant enough to be noticed. At this point, both large numbers of exit holes and large quantities of whitish frass are observable. Once the infestation is noticed, management, as with lyctids, depends on the extent of the infestation. The options are essentially the same as those listed for management of lyctid beetles.

BOSTRICHID (false) POWDERPOST BEETLES

The size of various species ranges from .64 cm (1/4 in) (most common species) to 5.08 cm (2 in) (uncommon species). All of the species are elongated, cylindrical, compact beetles with a flatheaded appearance in profile. The larvae are whitish, similar to other powderpost beetle larvae. Their life cycle is relatively short (about a year).



Bostrichid Beetles

There are several species in this group. Among the well-known species are the bamboo borer, the red-shouldered shot-hole borer, the oriental wood borer, the black polycaon, and the lead cable borer. Some of the species are pests of stored products such as grains.

Although this group reinfests wood, it rarely does severe economic damage. Most damage noticed in construction timbers occurs before curing while moisture content of the wood is high. An exception is bamboo and weakened (from moisture or other damage) structural timber, in which considerable

damage may occur. The appearance of frass is similar to that of lyctids, except that it often forms small cakes or clumps. However, unlike the lyctid powderpost beetles, exit holes are free of frass and are .08 - .94 cm (1/32 - 3/8 in) in diameter, depending upon species.

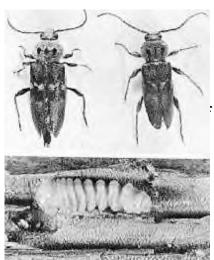
OLD HOUSE BORERS

This pest, a native of northern Africa, spread to the U.S. through Europe, and is now ranked second to termites as a pest of seasoned wood in structures. Its distribution is primarily along the east coast, with occasional findings in the other states east of the Mississippi River. The old house borer, *Hylotrupes bajulus*, is a large brownish-black, slightly flattened beetle that ranges from 1.57 – 2.54 cm (5/8 – 1 in) in length. It is a long-horned beetle and has two prominent bumps on the prothorax. The larvae are also large (up to 3.18 cm [1 1/4 in] long) and homeowners may hear them making gnawing sounds (clicking). Unfortunately, evidence of their presence, bulging of the surface wood, only occurs when larvae are near maturity. Eggs are placed in small cracks or in the joints between floor joists and other structures.

The life cycle in the northeastern states may take six to eight years or longer to complete, while in the southeast, the life cycle takes only three to five years. Adults may remain in galleries for up to ten months before emerging. Once emerged, usually in June or July, they live just a matter of weeks before they mate, lay eggs and die.

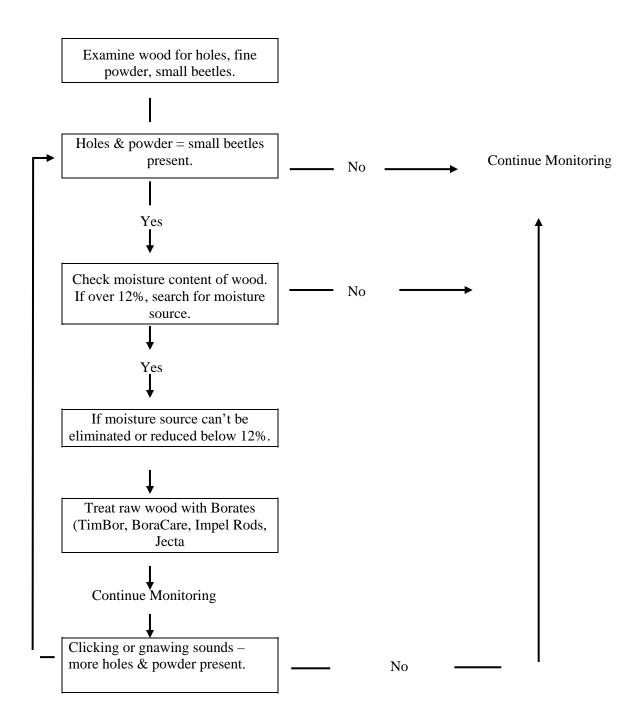
The old-house borer usually occurs in new, not old wood, as the name implies. However, it usually escapes notice until years after the completion of the structure. Infestation by a second generation of borers occurs rarely in well-ventilated, centrally heated structures. When such reinfestation occurs, there may be overlapping generations of borers in the structure for many years.

Favorite attack sites include attic framing, floor joists and wood studs. The larvae may reduce the sapwood area of these timbers to mere powdery frass. Luckily, the damage is localized. The fecal pellets are rod-like and crumble easily. The most characteristic feature of infestation is the damage, which is striking because of the size (up to .94 cm [3/8 in] in diameter), shape (oval) and rippled appearance



in the galleries. Just prior to emergence, larvae may create bulging in the wood. Exit holes are also oval in shape and surrounded by frass and feces.

WOOD DESTROYING BEETLES



NOTE: Holes and powdered frass will not disappear. If holes increase in number and jeopardize structural integrity of building, replace damaged wood with borate-treated wood.

CARPENTER ANTS

Carpenter ants (*Camponotus spp.*) are social insects which live in small to occasionally large nests. Unlike other ants found in structures, they excavate wood and build nests in it, but they do



Carpenter Ant Queen & Workers

not eat the wood. They occur throughout the contiguous 48 states and Hawaii, especially in the Pacific Northwest and the northeastern states. Carpenter ants are nocturnal forest-dwelling insects that, in nature, live in dead and rotting logs and trees, under stones and in leaf litter at elevations up to 9,000 feet.

Carpenter ant workers are large (.45 - 1.57 cm [3/16 - 5/8 in] long), usually black (although not invariably so) and can inflict painful stings. The waist between the thorax and abdomen, unlike most structure-infesting ants, has a single node, and the overall profile is

continuous. The queen is up to 1.42 cm (9/16 in) in length and, as with the male, may bear wings during the swarming season.

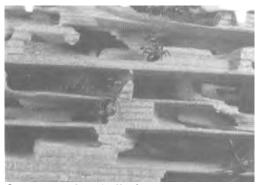
The larvae are white and legless and are fed by the workers. Pupae are also white and often are carried about by workers if the colony is disturbed. The foods of adults are sugar and sometimes proteins found in or around a site. Adult ants often feed on aphid honeydew found on plants infested with large populations of aphids. Winged adults emerge from March to July, depending upon location, and establish a nest in moist wood or a cavity adjacent to wood. The colony grows over a three-to-six year period before it matures. Winged swarmers appear in the nest in the late fall, but do not fly to start new colonies until the following spring.



Eggs, Larvae & Pupae

Swarming begins during the first warm or wet days of the year. New housing built on cleared woodlots that previously supported carpenter ants is generally the most troubled. Nests are found in water-rotted wood under shower stalls, under leaking roof-valley downspouts, in window sills where water accumulates, in poorly ventilated areas, and sometimes under insulation in attics. The larger and more long-lived a carpenter ant colony is, the greater is the structural damage.

Outside, carpenter ant workers forage for such foods as honeydew, insects and ripe fruit juices. Ants are not as active during winter. Carpenter ants often move into structures during fall to forage for sweets after plant aphids disappear. Those that have invaded structures seek out



Carpenter Ant Galleries

sweets, meats, fruit juices and moist kitchen refuse. Since carpenter ants are usually not very active indoors during winter, an occupant's ant complaint during winter is a sure sign of an indoor nest. Carpenter ants usually leave structures for the outside during summer. Carpenter ant nests consist of galleries that normally run with the grain of sapwood and have large interconnections which are free of wood shavings, mud and feces, and appear smooth and sanded.

Wood shavings and frass are thrown out of the nest through slit-like exit holes in the surface. Small piles of sawdust-like material may build up below tunnels. During summer months, ants are active at night when chewing sounds are audible.

The nest location may not necessarily be in the building; it may be a hundred feet or more away in a stump or decaying log.

Access to buildings is through ground connection, utility wires or branches touching the building. Since moisture is required to sustain a colony for any length of time, a carpenter ant nest indoors is normally near a moisture-laden area. Indoor nest locations may be in door and window frames, wall voids, roof/ceiling of flat deck porches and hollow porch columns, or behind fascia boards.

Carpenter ants are multi-queened and usually excavate wood previously decayed or damaged by other agents. They generally forage in humid atmospheres (under debris, in damp crawl spaces or in vegetation on building walls) where they find softened wood. Carpenter ants are not thought to be able to start tunnels in wood dryer than 12% moisture content, and some species even have high humidity requirements for the nest.

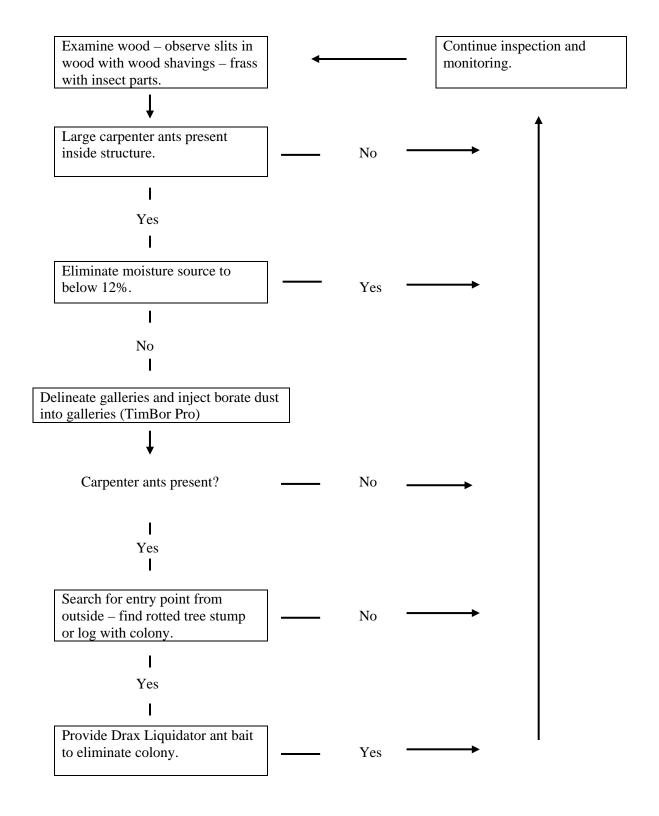
DAMAGE, PREVENTION AND MANAGEMENT

If ignored for many years, structural damage caused by carpenter ants may be extensive and severe. The damage rarely causes structural failure unless the wood is stressed by strong winds or heavy furniture placed on the infested timber.

Prevention methods include eliminating moisture sources in the house, breaking connections to the outside, ensuring good ventilation to crawl spaces, sealing all gaps in wood members, removing wood debris from around the structure, and using borate-treated or pressure-treated lumber in areas subject to moisture.

The most difficult part of treatment is locating the nest, without which the problem cannot be eliminated. If the nest is outside the building, the infested log, stump or other wood item should either be eliminated or removed. Inside the building, the infested areas may be sprayed or dusted with a borate insecticide. In inaccessible areas, wood may require drilling and injection with the pesticide. Chemicals of choice include disodium octaborate tetrahydrate (DOT), silica gel or diatomaceous earth. Some slow-acting baits such as Drax Liquidator may be effective.

CARPENTER ANTS



CARPENTER BEES

Carpenter bees are smooth and shiny solitary bees with a mostly black abdomen. Carpenter bees are similar in appearance to bumble bees, but lack hair on the dorsal side of the abdomen, except on the first segment.



Carpenter Bee

developing larvae.

They bore into wood to make a tunnel of cells provisioned with pollen in which they lay eggs and to supply developing young. The tunnel is divided into cells where the individual larvae develop. The tunnels bored by carpenter bees may cause structural damage to buildings where they nest. Typical nesting sites in a structure include fascia, window trim, eave areas, rafters, wood shingles, wood siding, patio furniture and exterior wood trim. Although many different types of wood are selected for nesting sites, softer woods are preferred. Additional damage to the structure can be made by woodpeckers as they bore into the wood to feed on the

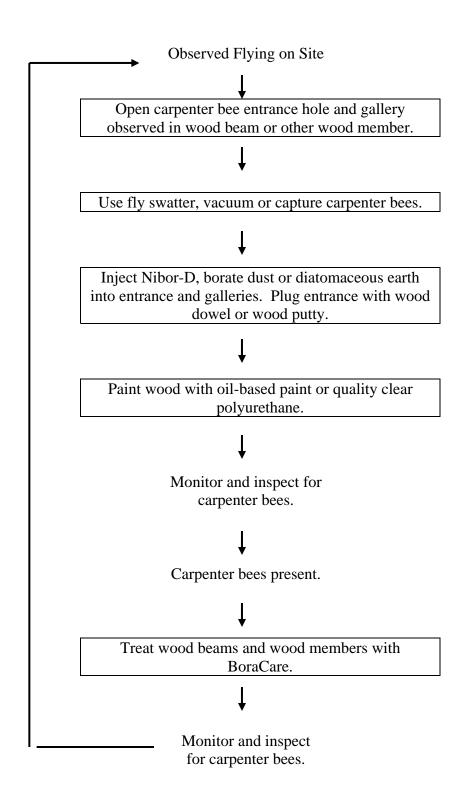
INSPECTION AND MONITORING

Inspect the bottom edges of exterior exposed wood for $1.27 \, \mathrm{cm} \, (1/2 \, \mathrm{in})$ diameter round holes drilled vertically. These are carved by the female carpenter bee forming right angle branches of cells. The male flies aggressively around to protect her while she works. If the hole is sealed, the nest is complete with cells, pollen provisions and eggs or overwintering developing larvae. Adult carpenter bees will emerge in the spring. Only the female carpenter bee can sting. Adult carpenter bees feed on pollen and honey.

MANAGEMENT

Good quality oil-based paint on the wood (especially bottom edges of exposed beams, fascia, etc.) will prevent and exclude the female bee from constructing the nest. If the nest is in the process of being carved into the wood, dusting inside the hole with diatomaceous earth, TimBor Pro or other low-risk dust pesticide will deter further damage and kill the developing eggs or larvae. Woodpeckers will attack live larvae inside the cells by boring through the wood.

CARPENTER BEES



ARGENTINE ANT (*Iridomyrmex humilus [Mayr]*)

The Argentine ant, native to South America, now widely ranges throughout the United States and the world. This highly adaptable ant is the most common of the trailing ant species that invade structures in search of foods. Its natural range is only limited by cold temperatures. The Argentine ant has one node on the petiole, a musty odor when crushed, carries no known diseases, and has no public-health importance. It is very aggressive, has no natural enemies, and drives other ants away. Although the Argentine ant bites, it doesn't normally attack human beings.



Argentine Ant

Argentine ant nests are usually located in moist areas around refuse piles, under stones or concrete, rotten wood, bird nests, beehives, and in tree holes. In winter, colonies move deep into the soil. Although it seldom nests indoors, nests are sometimes found in buildings near heat sources. This ant is multi-queened, very prolific, and supports large colonies (thousands to tens of thousands) but seldom swarms, because breeding takes place in the nest. The Argentine ant is a major pest in structures, and is commonly seen near baseboards, windows, and water pipes, seeking food or to escape too-wet or too-dry

outdoor conditions. It is often found on potted plants because it tends scales, mealy bugs and aphids, from which it obtains honeydew. Indoors they feed on meats, sweets, dairy products, eggs, fats and oils, but prefer sweets. Argentine ants also feed on termites, other ants, fly larvae, and cockroaches. Argentine ant eggs hatch in 28 days, the larval stage lasts 31 days, the pupal stage lasts 15 days, and complete life cycle is 78 days.

PHARAOH ANT (Monomorium pharaonis L.)

Originally from the African tropics, the pharaoh ant is a trailing species with two nodes on the petiole, twelve segments in the antennae, and a three-segmented antennal club. Its color is yellow-to-red, and the pharaoh ant is .25 - .15 cm (1/10 - 1/16 in) long. This ant forms extremely large colonies (a million or more workers) and is becoming a dominant indoor pest because of its broad diet and habit of colony budding. Infestations may be established months before being recognized. Pharaohs are one of the few North American ants that are active all year.



The pharaoh ant prefers to nest at temperatures between 27 - 30°C (81 – 86°F). In the North, pharaoh ants do not nest or survive winter outdoors. Indoors, this species is commonly transferred between buildings in furniture, food packages, laundry, and other items. Indoor nests may be found by examining areas adjoining heating systems and searching for ant trails near hot-water pipes.

Pharaoh Ant

water leaks.

Although pharaoh ants forage on many foods (they are especially fond of mint-apple jelly), worker ants need protein and carbohydrates from dead insects, meats, bacon, liver, blood, and honey. A constant food source seems important for pharaoh ants. Removing the food source has sometimes caused pharaohs to leave the building. Pharaoh ants penetrate packaged food and may gnaw holes in silk and rubber. Sources of moisture draw foraging ants to kitchen and bathroom faucets, dishwashers, water coolers and

This ant is extremely difficult to manage in structures because colonies tend to multiply (or bud) when treated with chemicals. Since most buildings provide abundant habitat, budding occurs as queens leave the colony accompanied by a number of workers who aid in the establishment of a new colony.

Budding often produces more colonies than the original one that provoked the use of pesticides.

The entire life cycle of workers is complete in 38 to 45 days at room temperature, and life span is about 60 to 70 days. There may be twelve or more pharaoh ant colonies in a building; however, only ten percent of the workers forage for food or water at any given time.

Pharaoh ants prey on bedbugs, and pose significant health threats, especially in hospitals. They may carry more than twelve different pathogenic disease organisms picked up from bedpans, toilets, drains, and washbasins. Once the ants are infected, pathogenic organisms quickly spread through the colony from direct contact as well as through food exchange.

PAVEMENT ANT Teramorium caespitum (L)

Pavement ants, originally from Europe and Asia, are distributed mostly in urban areas. They are common along the Atlantic seaboard, less common in the southern states and uncommon inland except in large cities such as Cincinnati and St. Louis. Pavement ants are rarely found in California. Although this ant does not compete well with native ants in rural areas, its range seems to be increasing.



Pavement Ant

The pavement ant is a small, .3 cm (1/8 in) long, blackish-brown species with two nodes on the petiole, a twelve-segmented antenna, a shiny abdomen, dull red-brown head and thorax. This is caused by minute, but easily visible parallel grooves. It has pale legs and antennae. The thorax bears two small spines on the top rear. Most complaints about small ants are caused by annoying pavement ants invading structures throughout the year, especially during summer when they get into everything from food to shoe polish.

Pavement ants nest outside under rocks, next to pavement edges, on door stoops and patios, and also establish colonies inside buildings between foundation and sill plates. This species enter through heating ducts, cracks in the slab and other open areas, and nest in wall voids and bathroom plumbing trap areas. Pavement ants may bite and sting causing an allergic reaction or rash.

Pavement ants store debris including sand, seed coats, dead insect parts, and sawdust from building construction in the nest, which the workers clean out when the nest needs to be expanded. This material is often seen in small piles on basement floors where it may be confused with carpenter ant frass. Pavement ants normally swarm in late spring, but large swarms may originate inside heated structures at any time of year.

Pavement ants are omnivorous scavengers with few food preferences, but they seek sweet and greasy materials, dead insects, and seeds. Outside, they tend honeydew-producing insects (root aphids and mealy bugs), and are often pests on eggplants, peanuts, and strawberries. Closely related, trailing species are often introduced via tropical plants into structures, where they flourish in warm, moist environments.

ODOROUS HOUSE ANT (Tapinoma sessile [Say])

The odorous house ant is a trailing, non-stinging, native species that occurs in all 48 continental states from sea level to over 10,000 feet in elevation. It has a single node on the petiole, is brownish to black in color, and .3 cm (1/8 in) long. Colonies are multi-queened and seldom swarm. The odorous house ant (and the Argentine ant) is probably the most common found in North American buildings. It is primarily distinguished from the Argentine ant by a darker color and an unpleasant odor when crushed.

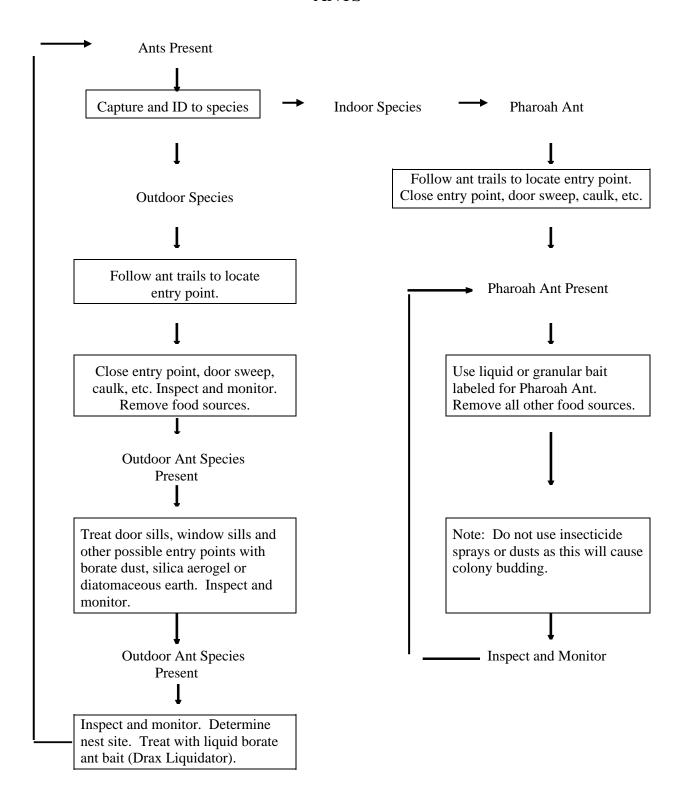


Odorous House Ant

Outside, odorous house ants tend honey-dew-producing insects. Inside, workers prefer sweets but, strangely, sweet baits are seldom effective. Although this ant may invade structures at any time of the year, it becomes an indoor pest at the start of the rainy season, when aphids and honeydew are washed down from plants by rain, and then again late in the year when leaves fall.

Odorous house ants nest outside, are usually shallow and located under boards or stone. Indoors, the nests are found in walls, woodwork, under floors (especially around heat sources), and sometimes in old termite tubes.

ANTS



BROWN ROT

Wood rots are a group of microscopic organisms (fungi) that discolor and decay wood. These fungi are unable to produce their own food so they feed upon natural organic substances such as wood and paper, etc. Fungi fruiting bodies release many spores that are moved by wind and rain. When the spores land on wood in the presence of water, they germinate, sending out thread-like hyphae. Enzymes secreted by the hyphae break down organic matter in wood so the fungi can use it for food. For fungi to use wood for food, it must have oxygen, $4 - 38^{\circ}\text{C}$ ($40 - 100^{\circ}\text{F}$) temperature range, a supply of moisture and a food source – wood.

Brown rot fungi feed on the wood's cellulose, a component of the cell wall. The fungi leave behind the brown lignin, which holds the wood cells together. Infested wood may be greatly weakened and becomes a darker brown than normal. Brown rot causes wood to crack across the grain and shows cubical checking. When brown rot damaged wood is dried, it will turn to powder when crushed. Brown rot that has dried is sometimes called dry rot.

Treating wood with borates (BoraCare or TimBor Pro) will prevent brown rot and stop brown rot from further damaging the wood.



Brown Rot Fungi

WHITE ROT

Wood rots are a group of microscopic fungi that attack and decay wood. These fungi cannot produce their own food so they feed on natural organic substances such as wood and paper, etc. Fungi fruiting bodies release spores that are carried by wind or rain until it reaches a susceptible substrate. When the spores land on wood where there is oxygen and $4 - 38^{\circ}\text{C}$ ($40 - 100^{\circ}\text{F}$) temperature, they germinate and send out hyphae to break down wood for its nutrients.



White Rot Fungi

When white rot attacks wood, it breaks down both lignin and cellulose causing the wood to lose its color and appear whiter than normal. Wood infested with white rot will shrink and collapse, eventually losing its strength and becoming spongy. Wood with white rot usually does not crack across the grain.

Wood treated with borates (BoraCare, TimBor Pro) will prevent white rot from infesting wood and/or stop further damage to the wood from white rot.

WATER-CONDUCTING FUNGUS, Poria incrassata

Poria can attack wood without the initial presence of water. This wood rot fungus can transport water for several feet through large root-like structures called rhizomorphs. When established, it can quickly spread through a building and destroy large portions of the structural wood.



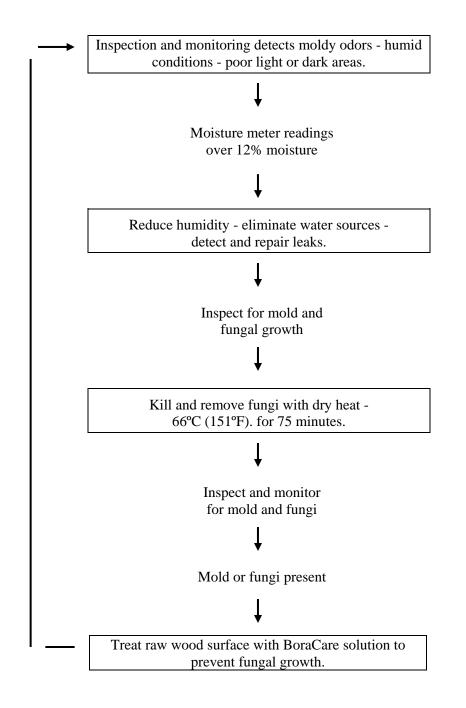
Poria incrassata

Typically, *Poria* infestations start in dirt-filled porches, damp crawlspaces and basements or where wood is in contact with soil. It can also begin in moist concrete or damp bricks. At first, yellowish mycelial fans grow over the surface of wood and other moist areas. The rhizomorphs are small hair-like hyphae that can grow to 2.54 cm (1 in) or more in diameter in older infestations. When *Poria* infested wood dries, it usually shrinks and cracks across the grain.

Wood treated with borates (BoraCare, TimBor Pro) will prevent *Poria* from infesting wood

and/or stop further damage to the wood from Poria.

MOLDS AND FUNGI



HOUSE MOUSE

INTRODUCTION



House Mouse Mus musculus

The house mouse (*Mus musculus*) easily adapts to living with people. It thrives in a wide range of climatic conditions in a great variety of habitats, feeding on most human food, and reproducing at a remarkable rate. House mice subsist throughout the United States, and are found in most areas of human habitation. They are also found living in the wild. They are common inhabitants of grassy fields, and a problem in residences and structures. Not only does the house mouse destroy food and cause damage to structures and personal possessions, it also has the potential to transmit diseases and parasites to people and domestic animals.

CHARACTERISTICS AND RECOGNITION

The house mouse is a delicate, agile little rodent. Adult weights vary by region and usually range from 14 - 28 gr (1/2 - 1 oz). Adult house mice vary in color from light brown to dark gray, but most often are a dusky gray or medium brown over most of their bodies, except the belly, which may be a slightly lighter shade of their general color but never white. The mouse has moderately large ears for its body size. The tail is nearly hairless and about as long as the body and head combined (6.35 - 10.16 cm (2 1/2 - 4 in). The feet are small in proportion to its body, and the eyes are also relatively small.

Under optimum conditions, house mice breed year round. Out-of-doors, house mice may tend toward seasonal breeding, peaking in the spring and fall. Environmental conditions, such as the availability and quality of food, can influence the frequency of pregnancy, litter size, and survival. Females may produce as many as ten litters of five young in each litter in a year. At very high densities, however, reproduction may nearly cease despite the presence of excess food and cover.

Newborn mice are quite undeveloped, weighing between .57 - .85 gr (.02 - .03 oz) and are nearly hairless. Their eyes and ears are closed, but within two weeks the body is covered with hair and the eyes and ears are open. At about three weeks, the young begin short trips away from the nest and begin taking solid food.

While mice primarily are active at night, some day activity occurs. Movements of house mice are largely determined by temperature, food, and hiding places. Home ranges of mice tend to be smallest where living conditions are good. Mice tend to travel over their entire territory daily, investigating each change or new object that may be placed there. They are very aggressive.

They show no fear of new objects. They dart from place to place, covering the same route over and over again. This behavior can be used to advantage in management programs. Disturbing the environment at the beginning of a program by moving boxes, shelves, pallets, and other objects can improve the effectiveness of traps. Mice will investigate the changed territory thoroughly.

Mice have relatively poor vision, and are also color blind. They rely heavily on smell, taste, touch, and hearing. Mice use their keen sense of smell to locate food and to recognize other individuals, especially those of the opposite sex. Taste perception in mice is also good. Mice use their acute hearing to detect and escape danger. An important sensory factor for mice is touch. Mice use long, sensitive whiskers near the nose and guard hairs on the body as tactile sensors to enable them to travel in the dark, pressing against walls and boxes, scurrying through burrows.

It is a challenge to mouse-proof a building or manage mice without understanding their physical capabilities. For their size they are excellent jumpers. They can jump against a wall or flat vertical surface, using it as a spring board to gain additional height. They can run up almost any vertical surface including wood, brick walls, metal girders, pipes, weathered sheet metal, wire mesh, and cables without difficulty if the surface is rough. They can run horizontally along insulated electrical wires, small ropes, and the like, with ease. They can squeeze through openings slightly more than .64 cm (1/4 in). They are quick to explore any physical change in their environment.

House mice prefer cereals over other items, although they feed on a wide variety of foods. Mice satisfy much of their water need with moisture in their food, but they drink if water is readily available. Mice have two main feeding periods, at dusk and just before dawn, and they are nibblers, feeding twenty or more times during evening rounds. In any territory there will be one or two feeding sites, dark and protected, where mice eat more than at other places.

Mice are territorial and seldom travel more than thirty feet from their nest. When food is nearby, mice may restrict their activity to a few feet. Males average slightly larger ranges than do the females. House mice may nest in any dark, sheltered location, in nests approximately 10.16 cm (4 in) in diameter and constructed of fibrous, shredded materials such as paper, cloth, burlap, insulation, or cotton, which generally look like a loosely woven ball. Outdoors, house mice sometimes dig and nest in small burrows.

HAZARDS OF INFESTATION

When mice infest stored food, the greatest loss is not what mice eat, but what is thrown out because of real or suspected contamination. Mice also damage personal property and structures by gnawing, including electrical wiring in buildings. House mice frequently take up residence in electrical appliances and end up chewing into the power supply.

House mice and their parasites are implicated in the transmission of a number of diseases. Salmonellosis can be spread when some foods are contaminated with infected rodent feces.

Mice are probably more responsible than rats for the spread of this disease. *Rickettsia akari* is the causal agent of Rickettsialpox, a disease causing a rash similar to chickenpox. Rickettsialpox is transmitted from mouse to mouse, then to people by the bite of the house-mouse mite. Lymphocytic Choriomeningitis is a virus infection of house mice that may be transmitted to people (mainly to children) through contaminated food or dust. The mouse can also be a major carrier of Leptospirosis (Weil's disease). Rat-bite fever can be transmitted by house mice, as can ray fungus, *Actinomyces muris*. Certain tapeworms are spread in house-mouse droppings, and ringworm, a skin fungus disease, can be carried to human beings by mice or contracted indirectly from mice through cats. Tularemia has also been linked to house mice.

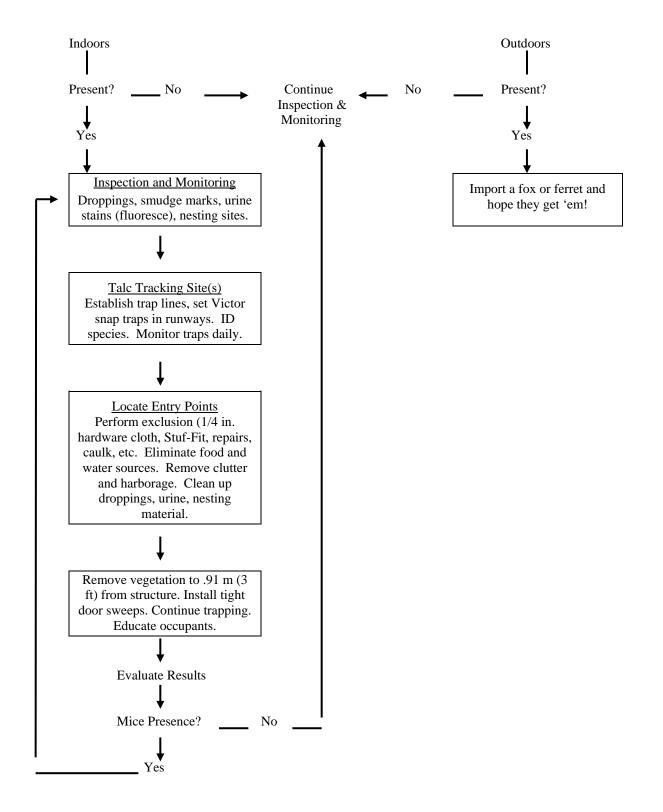
INSPECTION AND MONITORING

Sounds are common at night where large numbers of mice are present. Listen for squeaks, scrambling, and sounds of gnawing. An electronic stethoscope is useful.

Mouse droppings are frequently the first evidence that mice are infesting. Large cockroaches, bats, and other species of mice such as deer mice (*Peromyscus* sp.) and meadow mice (*Microtus* sp.), may produce droppings similar to those of house mice. Look along runways, by food, near shelters, and in other places mice may frequent. House mice occasionally make small mounds known as "urinating pillars." These consist of a combination of grease, urine, and dirt, and may become quite conspicuous. Look for many small drops of urine using a black light, since urine stains will fluoresce under ultraviolet light.

Like rats, mice produce greasy smears where dirt and oil from their fur mark pipes and beams. Recent gnawing damage on wood is light in color and will turn darker with age. Look for enlarged cracks beneath doors and small tooth marks. Such evidence frequently helps to distinguish between mice and rats. Look for wood chips with the consistency of coarse sawdust around baseboards, doors, basement windows and frames, and kitchen cabinets.

HOUSE MICE



DEER MOUSE / WHITE FOOTED MOUSE

The native deer mouse (*Peromyscus maniculatus* [Wagner]) is the rodent in the United States that most commonly carries the Hantavirus, and is implicated in most of the cases of human



Deer Mouse Peromyscus maniculatus

infection by this strain. The white-footed mouse (*Peromyscus leucopus* [Raphinesque]) also carries Hantavirus. The deer and white-footed mice are also the most likely native rodents to be found in or near buildings. The deer and white-footed mice often invade homes and structures that are closed for the season. If outside populations are large, structures may have numerous *Peronyscus sp.* present, which may result in substantial amounts of saliva, urine and droppings with the Hantavirus aerosolized into the interior air and in dust. The opportunity for human exposure is great when the structure is reopened for use. See Introduction to Mice for Hantavirus remediation.

CHARACTERISTICS AND RECOGNITION

Appearance

The deer mouse is the most widely distributed and the most variable member of the genus. Color ranges from pale grayish buff to deep reddish brown. The tail is always sharply bicolored, dark above and white below. Head and body are 7.11 - 10.16 cm (2 4/5 - 4 in) long and the tail is 5.08 - 12.7 cm (2 - 5 in). The deer mouse weighs only 19 - 35 gr (2/3 - 1 1/4 oz). The eyes and ears are moderate size and prominent and the tail is covered with short fur.

Habitat and Habits

The deer mouse is versatile and occupies nearly every dry land habitat within its range from

forests to grassland and a mixture. With the exceptions of Virginia, North and South Carolina, Georgia, Florida, Alabama, Mississippi and Louisiana, the deer mouse can be found throughout the continental United States (including part of Alaska) and Canada. In the east, deer mice are found from the Hudson Bay south to Pennsylvania and the southern Appalachians. They build a large globular nest in burrows in the ground, in trees and stumps, and buildings. The deer mouse feeds on seeds, nuts, acorns, berries, small fruits, and adult and larval insects, and can carry food in a cheek pouch to be stored in its nest. The home range is one-half to three acres or more. A summer population of 10 to 15 per acre is high, although they



White-footed Mouse Peromyscus leucopus

may congregate in winter. They rarely live more than two years in the wild. Females may show territorial behavior in the breeding season, which may vary with latitude, normally February to November. There may be two to four litters per year with one to eight naked and blind young

(usually three to five) per litter. Gestation period is 21 - 27 days. Deer mice are nocturnal, feeding mostly at dusk and dawn. They are excellent climbers and fast runners.

Appearance

The white-footed mouse is found in the east from Maine south to Georgia. Identifying the various species of *Peromyscus* may require a rodent taxonomist. The white-footed mouse is bicolored with the upper parts grayish to rich reddish-brown, with the belly and feet white. The tail is also bicolored. The head and body length are about 1.4 - 10.5 cm (3 9/16 - 4 1/8 in), tail length is 6.2 - 10.2 cm (2 7/16 - 4 in). Ears are small, 1.3 cm (1/2 in) and weight is about 10.6 - 42.5 g (3/8 - 1 1/2 oz).

Habitat and Habits

White-footed mice are nocturnal. They build nests in concealed locations such as old bird or squirrel nests, burrows, stumps, logs or buildings. They feed on seeds, nuts, fruits, beetles, caterpillars and other insects. Caches of seeds and nuts are stored near the nest. Home range is 1/2 - 1 1/2 acres. They are active year around. Females have two to six young per litter, and two to four litters per year. The gestation period is 21 - 24 days and females can begin breeding at 10 - 11 weeks old. The lifespan is two to three years in the wild.

INSPECTION AND MONITORING

Droppings

Observing droppings indoors where native mice have tunneled, fed and nested are telltale signs of their presence. Outdoors runways in grassy areas may be observed, and droppings may also be present. Fresh mouse droppings are dark and shiny, then turn dull and gray as they age. Large numbers of droppings in a small area indicate a feeding or resting site. Droppings and urine will also be found in the nest.

Runways

Outdoors runways may be distinct as grass is clipped and the trail may show. Inside the runways that are being used will show as dust free areas, usually next to walls or other objects.

Tracks

Outdoors in soft soil or dirt areas look for tracks and tail marks in the dust. Deer and white-footed mice (and others) have large hind feet with five toes and small front feet with four toes. Indoors a non-toxic tracking patch (talc) 15.24 x 25.4 cm (6 x 10 in) and .15 cm (1/16 in) deep can be placed on the floor to determine activity. Place several patches in the area near possible food sources, or other critical areas.

Visual Sightings

If possible, make observations at night as most *Peromyscus* are nocturnal. Use a powerful flashlight or spotlight to check storage spaces or other food or harborage sources. Disturbed mice will rapidly run to shelter.

PEST MANAGEMENT MEASURES

Management of native mice consists of preventive measures such as exclusion, sanitation, habitat modification, and population reduction with snap traps.

Exclusion

If you keep them out, they can't get in! Exclusion may be the most important aspect of native mouse management. All holes, cracks, crevices or other openings larger than .3 cm (1/8 in) must be filled, covered or otherwise blocked to keep mice out.

As the native rodents can gnaw through wood or other soft substances, burrow into soil, and are good climbers, keeping the structure in good repair is important. Use hard material such as metal flashing, concrete and 1/8 in. hardware cloth for exclusion. Doors and windows should also close tightly.

Sanitation

Keep food and water in clean, tightly closed containers that are resistant to rodent attack. Removal of clutter and debris will also deter rodent activity. If rodents are suspected or observed inside the structure, very strict procedures need to be followed.

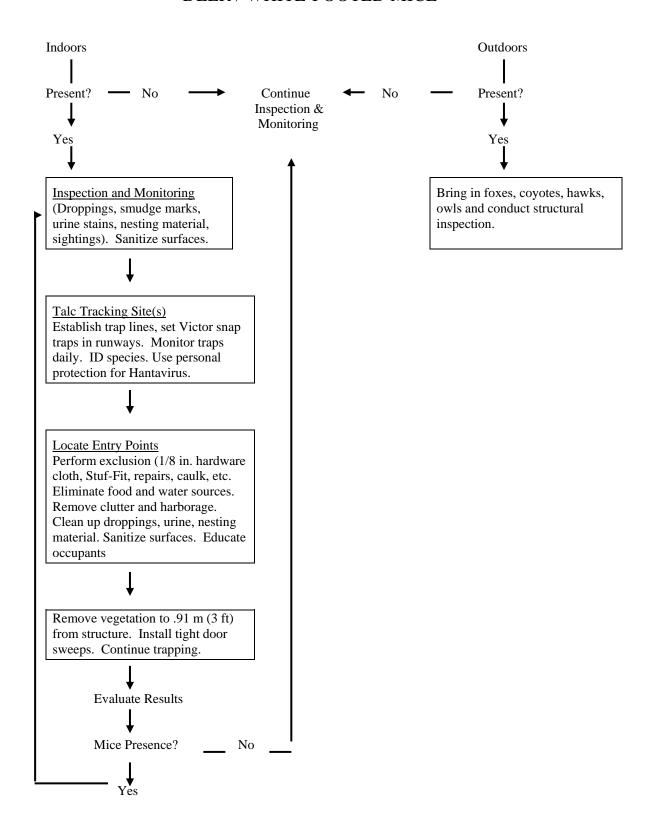
Habitat Modification

Another preventive or remedial measure that can be taken outdoors to reduce the opportunity for rodent/human exposure is to remove brush, weeds and other materials from around structures to reduce protected hiding places for rodents. Modifying protective cover makes native rodents more susceptible to predation by hawks, owls and other natural predators. A gravel barrier 10.16 - 15.24 cm (4 - 6 in) deep and .91 m (3 ft) wide next to the structure reduces rodent intrusion.

Trapping

Because of the risk of exposure to the Hantavirus, if native rodents are dwelling inside structures, lethal force in the form of snap traps is recommended. Do not use live traps. Do not use rodenticides or other toxic means for rodents inside structures. Baits that may be used in the snap traps are seeds such as conifer seed, chunky peanut butter, sunflower seed, oats, or cotton balls (plain or with vanilla flavor). Traps should be placed in observed runways or near resting and feeding sites. Check traps daily. Wear rubber or plastic gloves when handling killed mice. Remove dead mice and treat with a disinfectant to kill Hantavirus.

DEER / WHITE-FOOTED MICE



RATS

INTRODUCTION

A few vertebrates, such as rats and mice, are common pests in urban sites. Others may occasionally become pests when their presence conflicts with human use of a space.

Public concern for animal welfare and the potential risk from vertebrate poisons to people, pets, and other non-targets have made rules governing vertebrate pest management particularly strict. Laws and regulations at state and local levels may be more restrictive than federal regulations. The pest manager should ensure that the applicable regulations are satisfied.

CHARACTERISTICS AND RECOGNITION

Rats have caused more human suffering and economic damage than any other vertebrate pest. It is estimated that rats destroy 20% of the world's food supply every year, by feeding on or contaminating it. Rats have adapted to nearly all human environments. They live in granaries, fields, city sewers, attics, basements, street trees, on roofs, and food storage areas.

Rats can leap 1 m (3 ft) straight up and 1.22 m (4 ft) horizontally. They can scramble up the outside of a pipe 6.62 cm (3 in) in diameter, climb inside pipes of 3.81 - 10.16 cm (1.1/2 - 4 in) in diameter, and walk between buildings on telephone or power lines. Rats can swim through a half mile of open water, tread water for up to three days, swim against a strong current in a sewer line, and dive through a sewer trap to pop up inside a toilet. They can fall more than 15.24 m (50 ft) and survive.

Rats gnaw constantly to wear down their teeth which continue to grow, and their teeth are extremely hard. They commonly chew through building materials such as concrete block, aluminum siding, sun-dried adobe brick, wall board, wooden cabinets, lead sheathing, asphalt paving, and plastic or lead pipes. An adult rat can compress its body and squeeze through a 1.27 cm (1/2 in) opening.

Rats are very wary. Hundreds may be nesting in a city block, in underground burrows, in sewers, on roofs, inside buildings, and few people in the area will realize it. Their populations may be excessive.

Successful long-term rat management is not simple. The key is to manage the environment of rat populations, not individual rats. Rat management requires an integrated approach that includes non-lethal tools such as careful inspection, upgraded sanitation, and rat-proofing structures to exclude rat entry. Lethal methods may also combine the use of low-risk measures such as snap traps or Rat Zappers.

HAZARDS OF INFESTATION

Rats as Disease Carriers

Rats are responsible for the spread of many diseases. Sometimes they transmit the disease directly, by contaminating food with their urine or feces. At other times they transmit disease indirectly; for example, fleas may first bite an infected rat, then a person. Following are some typical diseases associated with rats.

Plague

The "Great Plague" of London killed half of the city's population. The "Black Death" of Europe lasted 50 years in the 14th Century and killed 25 million people. In the first quarter of this century, an estimated 11 million people died in Asia from plague. The disease is transmitted to human beings primarily by the oriental rat flea. The flea bites an infected rat and then, while feeding on people, inoculates them with the bacteria that cause disease.

Although no major urban outbreak of plague has occurred since 1924, this is not a disease of the past. A reservoir of plague exists in some populations of wild rodents in several western states, and human beings contacting these rodents could contract the disease. As suburbia expands into undeveloped areas, wild rodents can transmit the disease to urban rats. There is a concern that an outbreak of urban plague could occur in the United States.

Rat-Bite Fever

Rats bite thousands of people each year; most bites occur in inner cities. In some cases victims, particularly infants and bed-confined elderly, are bitten in the face while sleeping. Those who are bitten may develop rat-bite fever from the bacteria carried on the teeth and gums of rats. Although the disease is similar to flu, it can be fatal. It is of particular risk to infants.

Salmonella Food Poisoning

Rats frequent sewers, rotting garbage, cesspools, and similar sites where salmonella bacteria thrive. Rats can infest stored food or leave bacteria on dishes, silverware, or food-preparation surfaces, and thus transmit Salmonella food poisoning to people.

Leptospirosis or Weil's disease

This disease is seldom fatal to people. The disease organisms are spread from rat urine to water or food, and affect people through mucous membranes, minute cuts, and abrasions of the skin.

KINDS OF RATS

In the United States, the two typical species of rats are the Norway rat (*Rattus norvegicus*) and the roof rat (*Rattus rattus*). The Norway rat is also called the brown rat, house rat, sewer rat, and wharf rat. The Norway rat is considered the most common in the U.S. and is found in every state. The roof rat, also called the black rat, ship rat, and Alexandrine rat, is found primarily in coastal areas including California, Washington, Oregon, the Southeast and Middle Atlantic States, and the Gulf States.

The two species look similar, but there are noticeable differences. In general:



Norway Rat Climbing A Wall



Norway Rat (Rattus norvegicus)

A Norway rat looks sturdier than the roof rat; the roof rat is sleeker.

A mature Norway rat is 25% longer than a roof rat, and weighs twice as much.

A Norway rat's tail is shorter than the length of its head and body combined; a roof rat's tail is longer than its head and body.

A Norway rat's ears are small and covered with short hairs; a roof rat's ears are large and nearly hairless.

A Norway rat's snout is blunt; the roof rat's snout is pointed.

HABITS OF RATS

The knowledge of the life history, habitat, food requirements, patterns of behavior, range, and other factors is essential to the management of rat infestations. Since Norway and roof rats have similar habits, these discussions apply to either species.



Roof Rat (Rattus rattus)

Life Cycle

A mature female rat can give birth to about twenty young in a year (four to six at a time), if she lives that long. The average life span of a rat in the field is less than one year, although females live longer than males.

The young are born in a nest. They are hairless, and their eyes and ears are closed. Within two weeks their eyes and ears open, they become furry and rat-like, and they begin exploring the nest area. In the third week they begin to eat solid food, and imitate their mother in foraging, escaping, and watching for danger.

If the mother rat has become wary of rodenticides or traps, many of her young will learn to avoid them. This learning experience can make management difficult in sites where long-term rodent-baiting programs have been unsuccessful in the past.



Roof Rat (Rattus rattus)

Young are totally weaned at four or five weeks old, when they weigh about 45.52 g (1 1/2 oz), and at the age of three months, the young are independent of their mother. They will mate and continue the cycle in the same location, or will migrate to a new area.

Social Behavior

Rats live in colonies with well-defined territories that they mark with urine and glandular secretions. The colony has a complex social hierarchy with a dominant male leader and a "pecking order" of subordinate males and ranking females. The strongest and most dominant animals occupy the best nest and resting sites, and feed at their leisure. Weaker, subordinate rats are pushed out to less favorable sites, or forced out of the territory completely.

Rats are aggressive, and social conflicts are most common at feeding sites, prime resting areas, and territorial boundaries. Females fiercely defend their nest and young from other rats.

Rat Senses

Vision, Touch, Taste, Balance

Rats have poor vision. They are nearly color blind, and react to shapes and movement rather than identifying objects by sight. 9.14 - 13.72 m (30 - 45 ft) is the limit of their vision, and their eyes are adapted to dim light. Other senses, however, compensate for poor vision. They use their sensitive noses to locate food, follow pathways, tell whether another rat is friend or foe, and identify new objects in their territory. They use long whiskers and guard hairs to "touch" their way through dark burrows, pipe chases, wall voids, and other runways. Their ears detect faint sounds that signal danger. Rats can taste certain chemicals at a parts-per-million concentration.

This explains why rats often reject baits or avoid traps that have been contaminated with insecticides. Rats have an excellent sense of balance which allows them to walk on wires and always land on their feet in a fall.

Fear of New Objects (Neophobia)

Rats are wary of anything new that appears in their territory. A bait station, a trap, or a block of wood will be avoided for a few days until the rats become familiar with the new object. Even then, they approach cautiously. This fear of new objects can make baiting and trapping difficult. Rats will avoid poison bait when it is first placed. Later, they may nibble warily. If the poison bait makes them ill, but doesn't kill them, they will subsequently avoid similar baits or stations.

Food and Water

Rats need about one ounce of food daily. Norway and roof rats prefer different types of food. Norway rats prefer protein-based foods such as meat, fish, insects, pet food, nuts, and grain. Household garbage is ideal food for Norway rats. Roof rats prefer plant materials such as fruits, nuts, seeds, berries, vegetables, and tree bark. They occasionally feed on garbage and meats. Both rat species will feed on non-preferred food if nothing else is available.

Rats may hide or hoard food in hidden areas. This food may or may not be eaten when other food supplies run short. Hoarding food is important for three reasons. First, rats may be moving toxic bait into areas where perhaps the label does not permit its use. Second, rats may be hoarding poison bait while feeding on their regular food. In this case, a baiting program becomes ineffective. Third, hidden food may become a focal point for insect infestations.

Rats need water every day. The amount varies, depending on the moisture content of their food, but is usually around 14.17 - 28.35 g (1/2 - 1 fl oz). Rats prefer to nest where water is available.

Range

Rats usually begin foraging after dark. Most of their food gathering occurs between dusk and midnight, but short bursts of restlessness and activity can occur anytime, day or night. Rats commonly travel 30.48 - 45.72 m (100 - 150 ft) from their nest looking for food and water and patrolling their territory. It is not unusual for a colony that nests outdoors to forage inside a building 30.48 m (100 ft) away.

Nests

Outdoors, Norway rats usually nest in burrows dug into the ground. The burrows are shallow (less than 45.72 cm [18 in]) and usually short (less than 1 m (3 ft), with a central nest. Extra "bolt holes" are used for emergency escapes. They are hidden under grass or boards or lightly plugged with dirt. Burrow openings are 5.08 - 10.16 cm (2 - 4 in) in diameter. Indoors, Norway rats nest inside walls, in the space between floors and ceilings, underneath equipment, between and under pallets, and in crawlspaces, storage rooms, and any cluttered area that is normally unoccupied. Norways prefer to nest in the lower floors of a building.

Roof rats commonly nest above ground, in trees, particularly untrimmed palm trees, and in piles of wood or debris, vine-covered fences, and stacked lumber. Overgrown landscaping is also a prime nesting area. Roof rats will sometimes nest in burrows if above-ground sites are limited and Norway rats are not nesting in the area. Indoors, roof rats prefer to nest in the upper levels of a building in the attic and ceiling voids, near the roof line. But at times, they also nest in the lower levels of a building.

Both species also nest in sewers and storm drains, and highly unusual nest sites and can have several "hotel" nest sites in an area. A rat may spend a week in its home base and then move for a day or two into a secondary "hotel" nest site. Norway rats have been shown, on occasion, to have a home range of up to twenty acres when these secondary nest sites were included in calculations.

INSPECTION AND MONITORING

There are many signs of a rat infestation which can assist the inspector in identifying where rats are feeding and nesting, their patterns of movement, the size of the population, and the extent of infestation. This helps to influence what management measures to use, where and how to use them, and how much effort is needed to manage the population.

Signs of Rats

An inspection using a powerful flashlight after dark is the best way to see live rats. Dead rats are signs of either a current or past infestation. Dried carcasses and skeletons may indicate an old infestation. Fresh carcasses may indicate a recent poison baiting. If rats are seen during the day, the rat population is probably high.

Sounds

Squeaks and fighting noises in a building, clawing, scrambling, or gnawing sounds in walls may indicate the presence of rats. Use a stethoscope or electronic listening device to help pinpoint such noises.

Droppings

A rat may produce 50 droppings daily. Roof-rat droppings are generally smaller (1.27 cm [1/2 in]) than the Norway rat's (1.90 cm [3/4 in]). The highest number of droppings will be found in locations where rats rest or feed. Determine if a rat population is active by removing old droppings, and then reinspect a few days to a week later for new droppings.

Look at the appearance of droppings to determine if rats are present. Fresh rat droppings are black, glisten and look wet, and have the consistency of putty. After a few days the droppings become dry, hard, and appear dull. After a few weeks, droppings become gray, dusty, and crumble easily. Note that sometimes old droppings moistened by rain may look like new droppings; however, if crushed, they will crumble.

Urine

Both wet and dry urine stains will glow blue-white under an ultraviolet light (black light). Use portable ultraviolet light, as used in the food industry, to identify rat urine on food and other items. Other substances besides rat urine also glow, which can be confusing, so proper use of this inspection method, takes practice.

Grease Marks

Oil and dirt rub off of a rat's coat as it runs along walls. Grease marks build up in frequented runways. Look for grease marks along wall and floor junctions, and at pipes, ceiling joists, and sill plates, where rats swing around obstacles. Grease marks are also found at regularly used openings in walls, floors, and ceilings. Fresh grease marks along baseboards are waxy.

Runways

Outdoors, rats constantly travel the same route. Their runways appear as beaten paths on the ground. Look for such paths next to walls, along fences, and under bushes and buildings. Indoor runways of rats may appear as well-polished trails which are free of dust.

Tracks

A rat's footprint is about 1.90 cm (3/4 in) long, and may show four or five toes. Rats may also leave a "tail drag" line in the middle of their tracks. Look in dust or soft moist soil. Place a tracking patch in suspected rat areas to show footprints. A tracking patch is a light dusting of an inert material such as clay, talc (unscented baby powder), or powdered limestone. Don't use flour, which may attract insect pests. A good patch size is 30.48 x 10.16 cm (12 x 4 in). Apply patches in suspected runways and near grease marks. When inspecting tracking patches, shine a flashlight at an angle that causes the tracks to cast a distinct shadow. Note that a tracking patch is not the same as a toxic tracking powder. Tracking powders are diluted rodenticides in dust form. Tracking patches use nontoxic dust. Do not use a toxic tracking powder to make a tracking patch.

Gnawing Damage

A rat's incisor teeth grow at a rate of about 12.70 cm (5 in) per year. Rats keep their teeth worn down by continuously working them against each other and by gnawing on hard surfaces. Look for gnawing damage on floor joists, ceiling joists, door corners, kitchen cabinets, and around pipes in floors and walls as evidence of rat infestation. Gnawed holes may be 5.08 cm (2 in) or more in diameter.

Nest Sites

Roof rats often nest or store food in the attics of buildings. Their nests may also be found in trimmed dense vegetation.

Burrows

Outdoors, rat burrows may be found singly or in groups along foundation walls, under slabs and dumpster pads, in overgrown weedy areas, beneath debris, and in embankments. Look for a burrow opening that is free of dirt, leaves, and debris. The openings may be covered with smooth, hard-packed soil. Look for rub marks at the opening, and soil pushed out in a fanshaped pattern.

Fill the opening with a small amount of wadded-up newspaper or a few leaves and cover it with loose soil. Or, just kick in the open entrance to close it. If the rats are still using the burrow, they will reopen and clear the hole overnight. This is a good monitoring method to identify active burrows.

Pet Excitement

Cats and dogs may excitedly probe an area of floor or wall where rats are present, especially if the rats have recently invaded.

Odor

Heavy infestations have a distinctive odor which can be identified with practice. The odor of rats can be distinguished from the odor of mice.

Estimating Rat Numbers

It's not easy to tell how many rats are infesting a site. Rat signs, however, may categorize the population as low, medium, or high. In rat-free or low infestation conditions, no signs are seen. In the case of medium infestation, old droppings and gnawing can be observed and one or more rats are seen at night. No rats are seen during the day. When there is a high infestation, fresh droppings, tracks, and gnawings are common. Three or more rats are seen at night, and rats may be seen in the daytime as well.

MANAGEMENT

Most successful rat management programs use a combination of tools and procedures to reduce and eliminate a rat population. The methods combine habitat alteration and population reduction. Some of the tools, such as trapping, are lethal to the rat. Some tools are not. Ratproofing by making building repairs or increasing the frequency of garbage pickup are examples of non-lethal management methods.

Sanitation

Rats may ignore bait since it can't compete with the rats' regular food. Reducing rats' normal food supply encourages them to move to some other territory. This can be accomplished by closing or repairing open or damaged dumpsters and garbage containers, cleaning up food spills promptly, and not allowing food to be left out overnight.

Eliminate Hiding Places

Outdoors, remove plant ground covers such as ivy to .91 m (3 ft) from buildings. Remove high grass, weeds, wood piles, and construction debris that permit rats to live and hide adjacent to a building. Indoors, eliminate clutter in buildings and rarely-used rooms, basements, storage rooms, equipment rooms. Organize storage areas to remove clutter.

Rat-Proofing (exclusion)

The most successful long-term form of rat management is to build them out. Rat-proofing is an exclusion technique that makes it impossible for rats to get into a building.

Building Exterior

Seal cracks and holes in building foundations and exterior walls. Block openings around water and sewer pipes, electric lines, air vents, and telephone wires. Install 1/4 in. steel wire screen or hardware cloth on ventilation openings. Caulk and seal doors with door sweeps to ensure a tight fit, especially between door and floor threshold. Fit windows and screens tightly. Caulk and close openings on upper floors and the roof. Inspect under siding and repair damaged soffits. Repair breaks in the foundation below ground level.

Building Interior

Seal spaces inside hollow block voids or behind wallboard. Repair broken blocks and holes around pipes. Repair holes or stuff them with copper Stuf-Fit. Cover floor drains with sturdy metal grates secured firmly in place.

Trapping

Trapping for rodents is a widely used, low-risk method of rodent management. Trapping offers great usefulness and versatility in the form of snap or guillotine traps where toxicants cannot or should not be used. The snap trap is an effective method of killing rats when used correctly, and is advised for use inside structures. It has several advantages: there is less non target risk than from a toxicant bait; the pest manager knows instantly whether or not the trap has been successful; and trapping allows disposal of the carcass to eliminate hidden odor problems. Carcass disposal also eliminates the possibility of secondary infestation by blowflies and dermestid beetles that would feed on it. Traps should be strategically placed in sufficient number, otherwise rats will avoid them. Place bait on the unset trap for a few days until the bait is taken, then bait and set the trap.

Physical Condition of Traps

A trap physically incapable of holding a rodent should never be set out. Staples holding the spring should be firm; the trap jaw should be square and fit inside the trap base. The trigger mechanism should operate smoothly at the slightest touch. Use properly sized traps for the species to be managed: mousetraps for mice; rat traps for roof and Norway rats. The trap base should not be warped or the trap will rock when stepped on. If necessary, working parts should be lightly oiled with mineral or other inorganic oil, not machine oil. Traps should be kept away

from pesticides or other strong odors that might be repellent to the rodents. Don't clean a trap bloodied by a catch, since the odors enhance its acceptance. A shiny new trap increases the possibility of rejection in response to the "new object avoidance" instinct. For some situations, the best traps are those with enlarged bait pans (triggers) set for a light touch.

Enlarged Bait Pans

Some traps may need enlarged bait pans. Commercial traps with expanded bait pans are available, but the old style traps can easily be adapted with wire screen or light metal cut from metal cans or hardware cloth. The enlarged bait pan should be trimmed so that it is .63 cm (1/4 in) smaller than the trap jaw wire and securely fastened to the standard bait pan.

Placement of Traps

Traps with enlarged bait pans, if properly placed in runways, do not need to be baited, but baiting adds to their effectiveness. Smear peanut butter in the center of the bait pan, sprinkle oats lightly across the pan, or tie a nutmeat or dried fruit piece to the center of the pan. Meat, like sausage, bacon, or peanut butter is attractive to Norway rats, while fresh or dried fruit will draw roof rats. Cotton balls also are attractive to females of both rat species. Traps must be placed in the rodents' regular active runways, as indicated by the presence of feces, smears, or tracks.

Place light tracking patches of talc or other odorless, innocuous fine-particled material to find where the rodents are most active and place traps there. All traps should be set perpendicular to and across the runway so that the bait pan is in the runway, and against the wall or other vertical surface. Make narrow runways to force the animals to cross over the trap pan. Put traps in concealed places where rodents are more apt to be found rather than in places the trapper can easily reach. Trap the area heavily, every 3.05 - 3.66 m (10 - 12 ft). Map the locations so traps can be more easily recovered later or by someone else if necessary. Move traps to other areas after two weeks (the first area can be retrapped after a lapse of several weeks).

Adhere to good public relations practices, and pick up trapped animals as soon as possible (at least daily). In areas used frequently by the public, use trap stations to cover trapped animals in snap traps. This also protects them from accidental tripping by maintenance personnel. Don't place traps above food or food handling areas or in areas where pets or children can reach, as rat traps can break their small bones.

Leaving the traps unset for a few days may increase the catch by reducing the chance that wary rats will trip the traps without capture. Set traps with bait, if food for rats is in short supply and without bait if they have enough. When runways are located on rafters and pipes, set expanded trigger traps directly across them, fastening them securely to pipes with wire or hose clamps, and to rafters with nails. Use enough traps. Set five or ten traps in an active corner of a space. Set three traps in a row so that a rat, leaping over the first, will be caught in the second or third. If unsure about sites of activity, set traps along possible runways spaced ten to twelve feet apart.

Camouflage traps when only a few rats remain and are difficult to capture. Set traps in a shallow pan of meal, sawdust, or grain. In stubborn cases, expose food in shallow pans until the rats readily feed on it. Then add a buried trap. Inspect traps frequently to remove dead rodents and change old bait.



Victor Rat Trap

The Victor Snap Trap is the oldest trap and is still one of the most effective ways to humanely kill rats.

Rat Zapper 2000

The Rat Zapper 2000 is an electronic trap that humanely kills rats and mice.

The trap is a battery-powered plastic tunnel that is attractive to rodents and provides a bait placement inside. When the rodent enters the tunnel for the bait and steps

on a sensor plate, the rodent is given a lethal

shock. Empty the trap by turning it upside down, allowing the dead rodent to slide out. A blinking red light alerts you to the dead rodent in the trap. Remote sensing is also available for multiple traps.

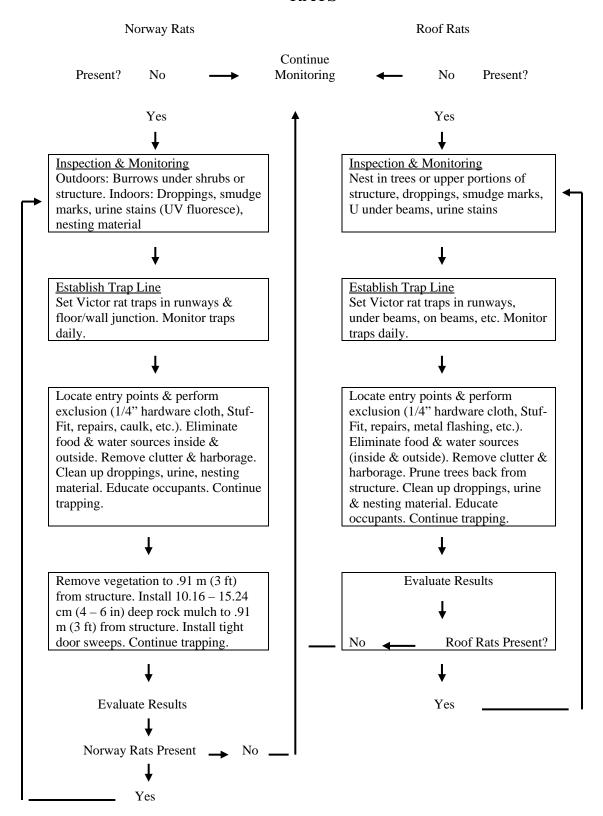
Glue Boards

Glue boards are not humane and must NOT be used on NPS sites.

Rodenticides

A rodenticide is a pesticide designed to kill rodents. Rodenticides are NOT recommended for use in NPS sites or other public areas.

RATS



EASTERN GREY SQUIRREL Sciurus carolinensis



Grey Squirrel

Eastern grey squirrels commonly occur in two color phases, grey and black, which leads people to think that there are two different species. Its most notable physical feature is its large bushy tail, which has important functions. It acts as a rudder when the animal jumps from high places, as a warm covering during the winter, as a signal to other eastern grey squirrels indicating an individual's mood, and perhaps as a sunshade. The tail can also be used to distract a pursuing predator.

The tracks of eastern grey squirrels are distinctive; forefeet leave a round print about 2.5 cm (1 in) long; the hind prints are more triangular, approximately 6 cm (2 in) long.

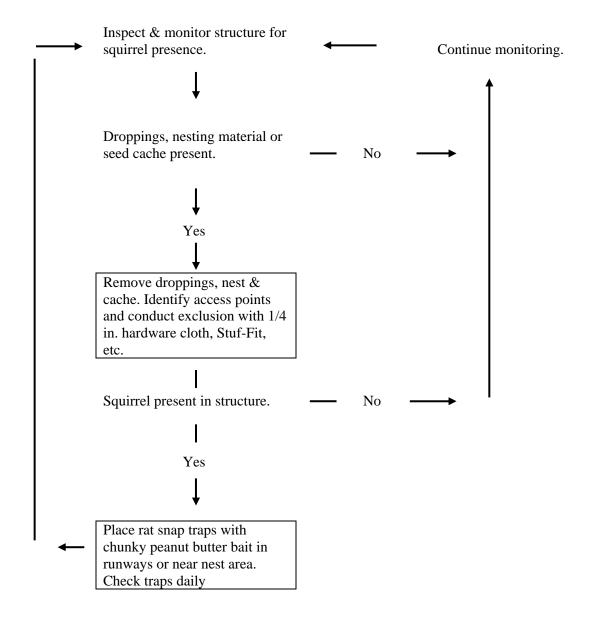
The eastern grey squirrel has two breeding seasons each year, the first in January and February and the second in June and July. Each of the mating periods lasts for about three weeks. Generally, only females over two years of age will breed in both seasons. Gestation takes 40 – 44 days. An average of three young are born, although the litter size may range from one to six.

Squirrels build nests near the tops of large pine, hemlock, maple, birch and oak trees where they are lodged in a large crotch or on a limb near the trunk. Mosses, grasses and shredded bark line the nest, occasionally along with cloth, paper, vegetation and bird feathers.

The newborn young weigh about 15 g (1/2 oz), mature quickly and at about 12 weeks, the young will be almost adult size and independent. The males reach sexual maturity at 15-18 months and the females at 11 months. The average lifespan is normally less than six years.

Grey squirrels can become a nuisance when they invade an attic, cause damage around the house, dig up bulbs in gardens or drive birds away from feeders. Prevent squirrels from climbing trees or poles by encircling them with a .61 m (2 ft) wide collar of metal 1.82 m (6 ft) off the ground. Overlap the metal collar to allow for tree growth. Trim trees back from structures to prevent squirrels from jumping onto them. Prevent squirrels from traveling on wires by installing a 1.82 m (2 ft) section of lightweight 6-7.62 cm (2-3 in) plastic pipe (slit pipe lengthwise to spread it open and place it over the wire). Close all openings into the structure with sheet metal or 1/4 in. hardware cloth to prevent squirrel access. If squirrels have gained access to the interior of a structure, rat traps baited with chunky style peanut butter are effective. Check traps daily to remove captured squirrels and reset traps.

GREY SQUIRREL



BIG BROWN BAT

Big brown bat, *Eptesicus fuscus* (Beauvois) is not a pest, and is actually beneficial to the Park, except for roosting in the attics. Adult big brown bats are about 10.16 - 12.70 cm (4 - 5 in) long including the tail, with a wingspread of 30.5 - 36 cm (12 - 14 in), and they weigh 11 - 17 gr (2/5 - 3/5 oz). They are found throughout southern Canada and the United States (except southern Florida). These bats usually give birth to two young during April to July. The big brown bat females form nursery colonies in structures in the spring (the males roost elsewhere). Later in the summer, the two sexes roost together. They commonly roost in attics, behind shutters and loose boards in buildings. They usually feed near the ground on beetles, wasps, ants, planthoppers, leafhoppers, flies, moths, etc.



Big Brown Bat (Eptesicus fuscus)

The big brown bat commonly hibernates in structures, caves, mines or rock crevices from December to April.

Winter exclusion efforts are not suggested if big brown bats are hibernating in the Park attics. Summer exclusion can be accomplished when the young are flying after mid-August. Seal all exit/entry points except one or two, and all holes .64 cm (1/4 in) or larger. After a few days to a week when bats are used to only the two exit points, install bat check valves (which allow bats to exit but not return) or seal exits after bats have left for foraging. Providing a proper bat house before the exclusion will allow the bats to remain in the area to feed on flying insects.

LITTLE BROWN BAT

Little brown bat, *Myotis lucifugus* (LeConte), is actually a benefit to the Park except for roosting in attics. Adults are about 7.92-9.19 cm ($3\ 1/8-3\ 5/8$ in) long, including the tail, with a wingspread of 22-27 cm ($8\ 11/16-10\ 5/8$ in). They weigh 3.4-14 gr (1/8-1/2 oz). Little brown bats are found from middle Alaska through southern Canada, and in the United States except Florida, Texas and southern California.

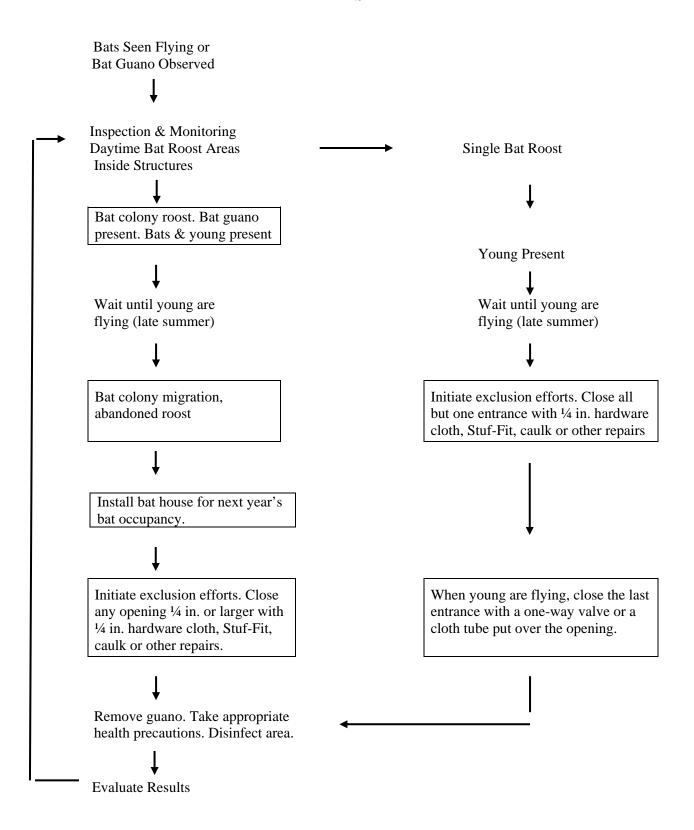


Little Brown Bat (Myotis lucifugus)

Little brown bats form nursery colonies in the spring. They feed on flying insects, especially flies and moths. They alternate feeding flights with rest periods to digest the catch. In the north, most little brown bats will migrate south where they hibernate from September/October through March/April in mines and caves in the eastern U.S.

If bats have left the attics of the Park structures in winter (and there are no big brown bats hibernating there), thorough exclusion of the attics at the Park can be accomplished. Otherwise, after mid-August when young are flying, close all exit/entry holes (over .64 cm [1/4 in]) except two exits. When bats have adjusted to those two exits, install bat valves or seal the last two holes after all bats have left for evening foraging. Providing a proper bat house before the exclusion will allow the bats to remain in the area to feed on flying insects.

BATS



BIRDS

INTRODUCTION

Birds provide enjoyment and recreation, enhancing the quality of life for those who view, enjoy, study, photograph, or hunt them. Over ten million people enjoy bird-watching as a recreational activity. For this reason, birds are protected by laws, regulations, and public opinion. However, birds can become pests when they create health hazards, roost on buildings, contaminate food, or create a nuisance. Pigeons and other birds, for example, cause human health problems when roosting in large numbers, and their droppings can foul buildings and walkways. Whether birds are seen as beneficial or harmful depends on time, location, and activity.

CHARACTERISTICS AND RECOGNITION

Pigeons (Worldwide)



Pigeon Columba livia

The domestic pigeon, *Columba livia*, developed from the rock doves of Europe and Asia where they nested in caves, holes, and under overhanging rocks on cliffs. They have adapted to window ledges, roofs, eaves, steeples, and other portions of structures.

Habits of Pigeons

Primarily seed or grain eaters, in urban areas pigeons feed on garbage, spilled grains, insects, food left by outdoor diners and food provided by bird lovers. Pigeons commonly feed, roost, and loaf together when ever possible. Feeding, roosting, and loafing sites are usually separate areas. Roosting sites are used for

nesting, congregating at night, and shelter in bad weather. Loafing sites will be close to the roosting sites used by inactive birds during the day. Feeding sites may be several miles away from the nesting location. When pigeons are not feeding or mating, most of their day is spent cooing, preening, and sun bathing. Sun bathing is most common in the morning of cool days.

Pigeons prefer flat, smooth surfaces on which to feed, roost and nest.

Male pigeons are sexually mature at three to four months old, females at six months. After pairing and mating, a nest is built by the mated pair. Nests are usually located in protected openings in or on buildings.

One or two eggs are laid eight to 12 days after mating and are incubated for 18 days before hatching. Young pigeons are full grown in less than a month, and are fledged at 37 days.

Pigeons mate year around and live from three to 15 years. Fecal material from pigeons is very acidic and may damage structures. Pigeon nests harbor mites, clothes moths, dermestid beetles,

and other insects that feed on the feces, feathers and other organic material. When the nest is abandoned by the birds, these nest inhabitants may find their way into the structure in search of food and habitat.

Starlings

European starlings (*Sturnus vulgaris L.*) were introduced into the United States in 1890 and rapidly expanded throughout North America.

Habits of Starlings

Starlings nest in holes or cavities, and on buildings and other structures. Starlings average two broods per year with four to seven young per brood. Both parents build the nest, incubate the eggs, and feed the young. The young birds leave the nest at about three weeks old.



Starling Sturnus vulgaris L.

Starlings form large flocks and migrate to cities as weather cools, forming large roost sites.

Droppings damage buildings and build up to such levels that they become a human health hazard. Starlings have been responsible for outbreaks of a number of diseases.

House Sparrows (Worldwide)



House Sparrow Male & Female, Passer domesticus (Linnaeus)

The house sparrow (*Passer domesticus*), also called the English sparrow, was introduced into the United States in the 1850's, and has spread throughout the continental United States except in heavy forests, mountains and deserts. It prefers human-altered habitats in cities and around farm buildings and houses.

The house sparrow is a brown, chunky bird 12.70 - 15.24 cm (5 - 6 in) long. The male has a distinctive black bib, white cheeks, a chestnut mantle around a gray crown, and

chestnut upper wing covers. The female and young birds have a gray breast, buff-colored eye stripe, and a streaked back.

Habits of House Sparrows

House sparrows average three broods per season with four to seven eggs per brood. Breeding can occur in any month, though it is most common from March through August. Eggs are incubated for about two weeks, and the young stay in the nest another two weeks.

Nests are bulky and roofed over, and located in trees and shrubs, on building ledges, in signs, on light fixtures, and under bridges.

Sparrows are aggressive social birds, often out-competing native species. They have no recognized migration patterns, and will stay in an area as long as food and nest sites are available. Young birds, however, move out of an area to establish new territories. Sparrows are tolerant of human activity, and will not hesitate to set up housekeeping in high traffic areas. House sparrows prefer to feed on grain. They will also feed on fruits, seeds, and garbage.

House sparrows can be pests in many situations. Droppings and feathers make unsanitary and smelly wastes. Sparrows can also become a pest when they nest inside a structure. The birds cause damage by pecking at rigid foam insulation in buildings. Sparrows transmit a number of diseases, internal parasites, and ectoparasites. They are thought to be a major reservoir of St. Louis encephalitis.

HAZARDS OF INFESTATION

Large populations of roosting birds may present risks of disease to people nearby. The most serious health risks are from disease organisms growing in accumulations of bird droppings, feathers, and debris under a roost. If conditions are right, particularly if roosts have been active for years, disease organisms can grow in these rich nutrients. Birds may contaminate food. When parasite-infested birds leave roosts or nests, their parasites may invade buildings and can bite, irritate, or infest people.

Histoplasmosis

This systemic fungal disease (mold) is transmitted to humans by airborne spores from soil contaminated by pigeon and starling droppings (as well as from the droppings of other birds and bats). The soil under a roost usually has to have been enriched by droppings for three years or more for the disease organism (*Histoplasma capsulatum*) to increase to significant levels. Although almost always associated with soil, the fungus, in rare instances, has been found in droppings alone, such as in an attic. Infection is by inhalation of the spores carried by wind, particularly after a roost has been disturbed.

Most infections are mild and produce either no symptoms or a minor flu-like illness. The disease can, on occasion, lead to high fever, blood abnormalities, pneumonia, and even death. The National Eye Institute (NEI) at National Institutes of Health has reported a potentially blinding eye condition, called ocular histoplasmosis syndrome (OHS). OHS results from infection by *Histoplasma capsulatum*. In this condition, the central part of the retina (the macula, used in straight-ahead vision) becomes inflamed and is damaged as blood vessels grow inside the affected area.

Cryptococcosis

Pigeon droppings appear to be the most important source of the disease fungus, *Cryptococcus neoformans*, in the environment. The fungus is typically found in accumulations of droppings in attics, on ledges, and on other roosting and nesting sites on buildings.

The disease is acquired by inhaling the yeast-like vegetative cells (two to three microns) of the organism. There are two forms of Cryptococcosis that may infect humans. Acne-like skin eruptions or ulcers characterize the cutaneous form with nodules just under the skin. The generalized form begins with a lung infection, and spreads to other areas of the body, particularly the central nervous system. It can be fatal. Like Histoplasmosis, outbreaks of this disease often occur after building renovation, roost clean-up, or other actions that disturb the old droppings.

Other diseases carried or transmitted by birds affect people to a lesser degree. Psittacosis, pigeon Ornithosis and Toxoplasmosis are normally mild in human beings, although serious illness or death can occur in rare cases. Pigeons, sparrows and many other species of birds have also been implicated in outbreaks of encephalitis.

Ectoparasites

Pigeons, starlings, and house sparrows harbor ectoparasites that can invade buildings. Some of these parasites can bite and irritate occupants. A long list of mites infest pigeons, but the northern fowl mite and chicken mite are usually the main culprits. These pests generally invade buildings from nesting and roosting sites. Other pigeon ectoparasites that may cause problems inside buildings are the pigeon nest bug (a type of bed bug), various species of biting lice, the pigeon tick, and the pigeon fly.

Droppings, feathers, food, and dead birds under a roosting or loafing area can also breed flies, dermestid beetles and other insects that may become major problems in the immediate area. These pests may fly or walk into windows, ventilators, cracks and crevices, and find other means to enter buildings. Structures that house museum specimens and historic artifacts can be invaded by dermestid beetle larvae that leave nesting and roosting sites.

Defacement and Damage to Structures and Equipment

Bird droppings under window sills, "whitewashing" down a building face, or accumulating on sidewalks and steps are the most obvious problems associated with roosts. Clean-up can be labor-intensive and expensive, particularly on high-rise buildings. Bird droppings are corrosive and will damage automobile finishes, metal trim, electrical equipment, and machinery. Down spouts and vents on buildings also become blocked by droppings, nest materials, and feathers. This accumulation of debris can attract insect pests such as dermestid beetles, spider beetles, and mealworms.

Legal Considerations

With very few exceptions, all birds are protected by one or more federal laws and regulations. Although pigeons, starlings, and house sparrows are considered pest birds and are not directly protected at the federal level, toxicants or repellents should be applied according to the product label and under the restrictions that apply under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA).

Non-target birds in the treatment area are protected, and any actions that kill or damage protected birds or their habitats would be a violation of various federal and state regulations. State and local regulations may require permits or restrict the actions taken against pest birds.

When in doubt, contact your State Natural Resources Agency or the United States Fish and Wildlife Service District office in your area for further information.

INSPECTION AND MONITORING

The first step in managing birds is to conduct a detailed and accurate bird survey. Surveys should be conducted early in the morning, midday, and again in the evening to correspond to the different activity periods of birds. The survey should not be limited to information about pest birds; non-target bird activity is just as important in order to minimize risk to these birds. The surveyor should investigate:

- What birds are present?
- How many birds are present?
- Are they residents, migrants, adults, juveniles?
- Are they nesting, feeding, roosting, loafing?
- Where do they eat and drink?
- What is attracting them to the various sites?
- Are the birds causing a health risk?
- Are the birds causing physical damage?
- If dispersed, where would they go?
- Is risk involved to non-targets?
- What are the legal considerations?
- Could there be public relations problems?
- Is exclusion or habitat modification practical?

MANAGEMENT

Habitat Modification

Habitat modification for birds means limiting a bird's food, water, or shelter. Attempting to limit the food or water of pigeons, starlings, and house sparrows may be difficult. Elimination of food and water to local bird populations must be accomplished at sensitive sites. These birds will

have a number of feeding and watering sites, often far from roosting and loafing sites. Where people are feeding birds in parks or lunch areas, education can help reduce this source of food. In some cases, people may pay little attention to requests to stop.

The most successful kind of habitat modification is to exclude the birds from their roosting and loafing sites (addressed in the section on exclusion).

Pigeons may be induced to move from an infested site by the persistent destruction of nests and eggs. However, nest destruction is ineffective against sparrows and starlings.

High-pressure streams of water spray are the most cost effective method of nest destruction. It destroys the nest, eliminates ectoparasites, cleans droppings and feathers from the nest site, and harasses the roosting birds. Use high-pressure sprays only where the water will not damage buildings or equipment. Remove all droppings and nest materials from the area.

When spraying is not safe, use a hook fastened to a long pole to the remove nests. When the nests are within 6.1 m (20 ft) of occupied sites, treat the immediate nest area with an insecticide/acaracide to eliminate ectoparasites.

Destroy nests every two weeks during the spring and summer months until the birds move to other nest sites. Nest destruction by any means is not allowed while young are in the nest.

Exclusion

Some building designs and conditions lend themselves to bird infestation. Flat ledges, openings in water towers and vents, unscreened windows, and other attributes make a building an attractive location for roosting, nesting, and loafing. Modification or repair can exclude birds. Typical solutions include replacing broken windows, adding screens, repairing damaged eaves or ventilation screens, eliminating large crevices, and blocking openings into vents, cooling towers, and roof-top equipment with hardware cloth or similar material.

Exclusion methods also include the use of netting, custom-designed sheet-metal or plastic covers, porcupine wire (Bird Barrier products, for example), electrified wires, and sticky repellents to keep birds from roosting on ledges, roof edges, window sills, building signs, and other surfaces favored by pest birds. Modifying flat ledges by the addition of a 45° angle plastic or metal device eliminates the site for roosting or nesting by birds, and is the most effective approach. Two advantages are that the birds are not killed and the management is comparatively long-lasting.

Netting

Netting is used to block access of birds to large roosting areas in structures. Netting is especially useful in warehouses and around mechanical equipment areas where aesthetics are of minor consideration. It has been used successfully on cooling towers.

Plastic nets are alternatives to metal and fiber nets in bird management. Plastic nets are normally extruded black polypropylene and are made with an ultraviolet inhibitor to reduce UV degradation. Knotted nets are also available. Nets will last from two to five years depending on exposure to sunlight. Use the best quality affordable.

Covers or Ramps

Custom-designed covers for ledges, window air conditioning units, and roof edges are the best technical solution to keep birds from infesting these sites. The cost of this method may deter you from exercising this option on large buildings that have extensive roosting sites. But covers are valid options where limited applications will keep birds off selected sites, and where aesthetics are an important consideration.

The covers usually consist of sheet metal installed at a 45° angle to prevent the birds from landing. Sometimes plastic inserts are custom-fit into the indentations in order to block off ledges.

Plastic or metal 45° angle inserts are now available commercially. These devices become almost invisible when properly installed.

Spikes

Porcupine wire, sharp metal spikes, or any similar "bed of nails" can deter birds from roosting on ledges. Where they can be used, they usually work fairly well. If aesthetics are important, these devices are usually limited to areas where they cannot be easily seen.

If pigeons are likely to drop nest material and other debris on top of the newly installed spikes in an attempt to create a new roosting surface, install metal spikes on potential landing sites above the installation.

Check metal spikes every six months for accumulated debris or nest material. Advise occupants to regularly remove falling leaves and other matter that can cover the spikes and reduce their effectiveness. Prune to ensure that no tree branches hang over protected ledges.

Sticky Repellents

Sticky repellents are tacky gels or liquids. The products are designed to be sticky enough to make a bird uncomfortable, but not so sticky that the birds are trapped. After a few attempts, the birds stop trying to land on treated surfaces. The active ingredient is polybutene or isopolybutene (the same substances used in some adhesive bandages) or petroleum naphthenic oils.

Before applying sticky repellents, clean ledges that are covered by bird droppings, feathers, and nest material with a wire brush, paint scraper, high pressure hoses, or by steam cleaning. Ensure that surfaces are clean and dry.

Seal concrete, unpainted wood, or brownstone with silicone or other sealant, paint, or shellac before applying repellent. Sticky repellents will be absorbed into porous materials.

Use a caulking gun to apply repellent. The depth of the bead necessary to repel different species of pest birds is roughly as follows: crows and sea gulls .95 cm (3/8 in); pigeons .63 cm (1/4 in); starlings .3 cm (1/8 in); sparrows .15 cm (1/16 in). The pattern of application will depend on the site and personal preference. The caulking gun should be held at an angle of 30-45°.

Place breaks in the bead every few feet to avoid trapping rainwater against the building.

Environmental conditions, particularly dust, make a big difference in the effective life of sticky repellents. In an area with no dust, applications should be expected to remain effective for a year or more.

Precautions should be followed when sticky repellents are used. Be sure migratory or other non-target birds are not harmed. Do not place sticky repellant material where it will become unsightly over time.

The disadvantages of sticky bird repellants are so great that they are not recommended for use in school sites or other urban areas.

Spike, glues and other deterrents become ineffective over time and are unsightly.

Remove Nests

Check state and local regulations that may prohibit destroying or disturbing nests containing eggs or young.

Ultrasonic Sound Devices

Tests by university, government, and private independent researchers have failed to demonstrate any efficacy against birds by any of the ultrasonic devices tested. These devices do not work against most birds.

Trapping

In many instances, trapping can be an effective supplemental measure. Trapping is especially effective against pigeons. Where a group of birds are roosting or feeding in a confined and isolated area, trapping could be considered a useful tactic.

The best time to trap pigeons is in the winter when their natural food is at a minimum. There are many pigeon traps to choose from; which type and size is best is a matter of choice. Most pigeon trapping programs use large walk-in traps. These can be $1.22 - 1.83 \, \text{m} \, (4-6 \, \text{ft})$ high and designed to be disassembled and moved. Another common type is a low-profile bob-trap that is about $20.32 \, \text{cm} - .61 \, \text{m} \, (8 \, \text{in} - 2 \, \text{ft})$ high. The door or entrance through which pigeons are lured is the principle feature of a trap.

Set traps in inconspicuous places where pigeons commonly roost or feed and where traps are not likely to be vandalized (a major risk in trapping programs). Trap placement is important, and moving an inactive trap just 3.05 - 4.57 m (10 - 15 ft) may significantly improve catches.

Feeding areas are the best trap sites, but are rarely on the same property as the roosting sites.

Rooftops that have water from cooling towers or air conditioning units are often good trapping sites in summer. The most difficult part of trapping is motivating birds to feed in a nonfeeding area so that they will follow the bait into the trap. Whole corn or sorghum are generally the best baits but wheat, milo, oat groats, millet, popcorn, sunflower seeds, peas, greens, bread, or peanuts can be very effective if the birds are feeding on similar food. Once a few birds have been trapped, putting different foods in for the birds can show which bait they prefer.

In the first few weeks of a program, scatter small quantities of bait throughout the area to start the birds feeding and determine the best trap sites. Some specialists leave traps propped open for the first few days to allow the birds to get used to them. When they calmly enter the trap, set it. Put water (a "chick font" is ideal) and bait inside and just a handful or so outside the trap. Leave one or two "decoy" birds in the trap to draw in other birds. Light-colored birds make better decoys than drab ones.

Remove trapped birds regularly (except for decoys), otherwise other pigeons will be frightened by fluttering trapped pigeons in the trap. Since pigeons can fly great distances and find their way home, trap and release is not normally effective. Trapped birds should be humanely destroyed.

Some experts recommend gassing, but many feel it is simpler and more humane to kill the bird by breaking its neck. Local rules may require taking birds to the animal shelter.

Sometimes, indoor roosting sites can be used as a giant trap. Pigeons often use attics, rooftop elevator houses, or empty floors of poorly maintained structures as nest and roost sites. By screening all but one or two entrances these areas can be made into a giant trap. Late in the evening, after a two-week acclimation period, these last entrances can be closed after the pigeons have settled down for the night. The trapped birds can be captured by hand or with butterfly nets.

Sparrow traps come in various sizes and shapes. The sparrow funnel trap is a double funnel that prevents sparrows from escaping after they have traveled through two funnels going for a food bait. Fine cracked corn, millet, wheat, or bread crumbs make good bait. Trap sites should be baited for a few days before you actually begin trapping. Sparrow traps are usually more effective when placed on the ground. Nest box traps attract a sparrow with a potential nest site. Once inside, the bird trips the mechanism, dumping the bird into a collecting bag. This trap also works against starlings, as does the center drop trap. The birds, attracted by food, drop through an opening and cannot escape. However, starlings are not usually good candidates for trapping programs.

Avitrol

AVITROL is a poison bait with flock-alarming properties used to manage different kinds of birds. There are different AVITROL baits for each pest bird species. Within 15 minutes of eating a toxic dose of AVITROL, birds flutter erratically and go into convulsions.

AVITROL should only be used by a professional who specializes in vertebrate animal control measures. Before using Avitrol, the park IPM Coordinator must obtain written approval from the regional IPM Coordinator.

Risks to Non-targets

Most lethal tactics in bird management pose some risk to non-target birds, as well as other animals. All migratory and game birds are considered non-targets, and are protected by various federal, state, and local regulations, as well as by public opinion. Care must be taken to minimize the threat to non-targets or to use tactics that pose the least risk.

First, identify any non-target birds or animals in the area.

Second, use tactics that are least at risk.

Third, modify tactics to minimize risk.

Fourth, monitor operations to be sure that no non-targets are being adversely affected.

Public Relations

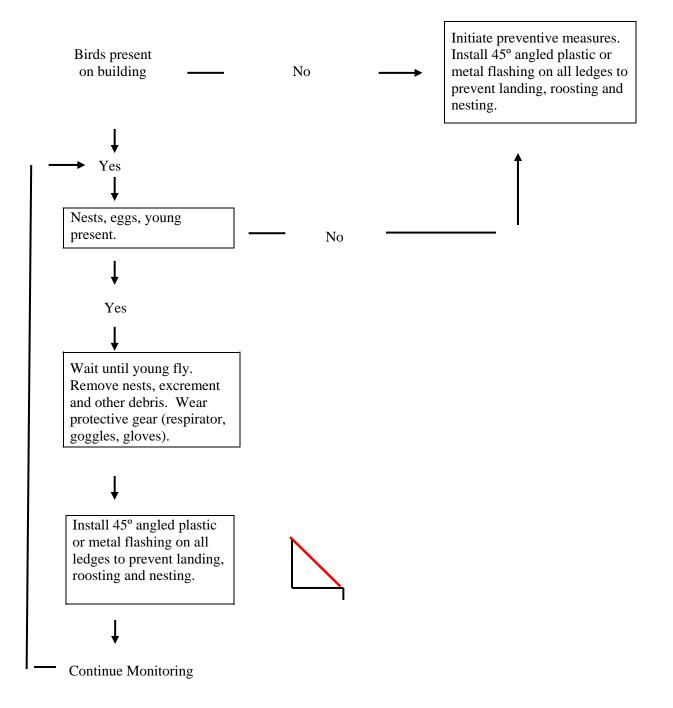
People often react more negatively to one dying bird than to accumulated pigeon droppings on sidewalks or potential risks of parasites and disease from bird roosts. Pigeons and sparrows can be seen as pets rather than pests. The public's perception of bird management operations must be considered. All bird management programs should put some effort into avoiding "people problems," particularly when using AVITROL or other toxic techniques.

BIRD DROPPINGS REMOVAL AND CLEAN-UP

Workers removing large quantities of bird droppings should follow these precautions to minimize risk from disease organisms in the droppings:

- Wear a respirator that is labeled to filter particles down to 0.3 microns.
- Wear disposable protective gloves, hat, coveralls, and boots.
- Wet down the droppings to keep disease spores from becoming airborne, and avoid drying them out.
- Put droppings into sealed plastic garbage bags and wet down the outside of bags.
- Dispose of trash bags. Disposal should be permissible through standard trash pick-up.
- When finished, and while still wearing the respirator, remove the protective clothing and place them in a plastic bag.
- Wash up or shower.

BIRDS



RACCOON Procyon lotor



Raccoon

Raccoons belong to the Procyonidae (those who came before dogs) family. This mammal is very intelligent and has a rounded head, short nose, small ears, and a sturdy body with thick, grayish-brown fur. Raccoons are easily identified by the narrow black face mask with a white patch above each eye, and white rings around their large, bushy tail. They average .61 – .91 m (2-3 ft) long, are 30.48 cm (12 in) tall, weigh 3.63-9.98 kg (8-22 lbs), and live from 10 to 13 years. Females produce one litter each year from one to six kits.

Raccoons are found in most of the U.S. and southern Canada in many varied habitats, especially near streams, ponds and marshes. For nesting sites it prefers warm, dry, dark, easily protected areas. It dens in tree hollows, hollow logs or caverns. In urban areas, raccoons may nest in crawl spaces, attics, basements or drainpipes. They are usually nocturnal, however, can be occasionally active during the day.

Raccoons will eat whatever their environment provides – from insects, nuts, fish, eggs, snakes and fruits to corn crops, poultry, garden and orchard vegetables, and from garbage cans. They have been seen dunking their food in water before eating it. They have keen senses of smell and hearing, and are excellent climbers.

<u>Inspection and Monitoring</u>: Check for entry points under buildings, into crawl spaces and basements, and plant ladders to attics. Noises at night may be another indicator of raccoon presence. Check for alternate access routes. Be sure there are no young in the nest.

<u>Management</u>: During the mating and nesting seasons, raccoons are attracted to warm, dry and dark areas as temporary homes, such as crawl spaces. Close off all but one access route before taking eviction actions. Be prepared to close off the last entry. Use ammonia-soaked rags placed in the vicinity of the nest. Bright lights may also help with the eviction. The nest area may need to be treated for fleas.

OPOSSUM Didelphis marsupials



Opossum

The opossum is the only marsupial found in the United States. It is the only mammal in the U.S. with a prehensile tail which can be used for grasping like a hand. The opossum has four fingers and an opposite thumb for grasping on each of its hind feet. It is a cat-sized mammal averaging .61 – .66 m (24 – 26 in) long and weighs between 2.72 – 5.44 kg (6 – 12 lbs). The opossum is a passive animal, but can be aggressive when threatened.

The opossum has an acute sense of hearing and smell. The life span ranges from two to three years

with mortality high in the first year of life. It is mostly a nocturnal animal, but a young animal can be seen during the day searching for food. The ideal habitat is woodland, farmland or neighborhoods with water nearby. The opossum is an adaptable animal and will thrive most anywhere. Females with young tend to use the same den sites for weeks at a time; they often use the abandoned burrows of other animals rather than digging their own. Potential den sites include woodpiles, culverts, barns, thickets, drainpipes; and under porches, buildings and sheds.

The opossum will eat anything it can find or catch, including mice, rats, worms, beetles, frogs, garbage, fruit, corn, etc. They are also immune to snake venom, and will catch, kill and eat snakes, including poisonous ones.

In northern states, opossums produce only one litter a year. The age of maturity for males is eight months; for females six months. The breeding season begins at the end of winter and the female gives birth only 12 - 13 days after mating to an average of 16 - 20 young. The young are the size of a grain of rice and must travel from their birthplace into their mother's pouch. After one week, the babies triple their size; after 60 - 70 days in the pouch, their eyes finally open, and they are the size of a mouse. Youngsters remain with their mother until they are three to four months old.

Opossums do not harbor diseases normally found in dogs and cats such as distemper or feline hepatitis. All warm-blooded mammals can contract rabies, but opossums are rarely found to be rabid.

<u>Management</u>: Do not leave garbage outdoors at night. Eliminate brush piles, access into buildings and holes under concrete slabs. Secure doors at night. Opossums seldom stay in one area for any length of time. They are excellent rodent and insect predators, and are more beneficial as scavengers than harmful for the little damage they may do.